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EDITORIAL NOTES.

Clearing Up—as Far as Possible.

THE miners who had not resumed work prior to last week went back willingly enough after the seven months' folleness. But the number who were able to return only equalled that of their wiser brethren who had made a start earlier; and the balance for whom no work can yet be found are now going on to the dole. The official returns of the number employed have ceased; they were stopped last week as the strength of the men taken on became adequate to requirement. The last computation we saw exceeded 700,000; and no doubt the complement has been made up everywhere. So the monstrous adventure—without equal in numbers of men, time, and disaster in this country—has ended; and the foolish leaders who organized and led it have retired from the limelight, with upon them the odium which they richly deserve. It was predicted that the men, their leaders being defeated, would return to work sullenly and unwillingly, and would (*vide* Mr. Cook's vapourings) set about destruction and refuse to raise coal to the same amount as previously—this a penalty to be inflicted on their employers for the longer shift. The facts are the reverse. The men everywhere are happy to be back again at work; they are not such idiots as to bring about the destruction of the property which gives them employment; and from most fields reports have come which show that the rate of production per man per shift is in excess of the pre-stoppage rate. In other words, the men are contributing their share to the replacing of the industry in a better state of prosperity. Thus the suggestions of vile conduct on their part on returning to work are being repudiated by action, which speaks louder than words. Approximately two-thirds of those who are at work have, according to Col. Lane-Fox (Secretary of Mines), resumed on the eight-hour day.

The Emergency Regulations have been withdrawn, except those governing certain matters relating to production, distribution, and export, which are kept pending for use if required. Export can only be carried out at present by permit; but even the prohibition in this regard, it is expected, will be withdrawn almost immediately. The export areas are anxious for this to be done. But it all depends on the rapidity with which coal supplies are equal to demand in all parts of the country; and this should not be long, seeing that people are only buying sufficient to meet immediate requirements at present prices—preferring to wait for the decline which is bound to come with increasing output, and lower demand for both home and export. Already reductions by a few shillings per ton have been made at the pithead and by retailers; and a further decline is forecast by members of the coal trade—the prediction varying in dimensions between 10s. and 20s. [Since this was written, the retail price of coal in London has been reduced by 16s. 4d. per ton.] The retailers of household coal are somewhat perturbed. While people are advised to buy only sufficient for present needs, until prices step down, the retailers find themselves with stocks of expensively bought foreign and British coal, which they cannot dispose of without loss if retail prices are immediately to respond to the reductions in pithead prices. That is a position which cannot be legislated for. In such circumstances as we have been passing through, a situation of the kind must come at some time or other. It finds gas undertakings in precisely the same state. Those that have been accumulating at big prices any stock they could get hold of, have now to work it off, and get on to cheaper coal as soon as possible; but in their case they can make their charges fit their circumstances—not being subject to gas competition, though they are to that of coal, electricity, and oil. The coal retailer who has exhausted costly supplies, and is now buying at a cheaper rate, can advantageously compete with his fellows who have been less fortunate. However, for all users of coal and all dealers in it, the transition period from the state of coal poverty to coal richness cannot be long in passing. Another phase of the situation is that the imports of coal have shrunk to a much lower level. Home supplies are fast approaching need; and the high price to which coal and freights from abroad have risen, have reduced incoming coal to the mere fulfilment of contracts which latterly were entered into as a safeguard against any extreme shortage in this country. It was stated in the House last Thursday that of the 2,500,000 tons of foreign coal for which the Government contracted for protective purposes, they had only 10,000 tons left; so that they should have a fairly well-balanced account in this regard. Very shortly we shall have in hand the returns which will show, by tonnage and values, how greatly the coal industries abroad have benefited by the folly of the Miners' Federation, which tonnage and values certify the negative help the folly received from the International Federation of Miners, despite the joy-rides to the Continent of Cook, Smith, and others.

Throughout the industries, there has been a heartening through the termination of the strike. Everywhere there are signs of new life and good anticipations; and contracts are being secured by several leading engineering and other firms. There is a lot of leeway to be made up. A seven months' wandering of an entire country from the direct course leaves a lot to be done to bring things to the normal. At the same time industry is looking anxiously for indications as to the effects of the strike on the national exchequer. When we read of computations such as 300 to 500 millions sterling as the cost to the nation; when Mr. Neville Chamberlain reports that the estimated cost of outdoor relief in the coal-mining areas alone from May 1 to the end of November has exceeded by £6,568,000 the cost which would have been incurred at the rate of expenditure of last April; when it is remembered how in all industrial areas unemployment has been heavier during the strike than the bad state of things preceding it—there is good cause for anxiety. The Federation of British Industries, in these circumstances, have addressed a communication to the Prime Minister appealing to him to give industry time to adjust itself to the new conditions before any further costly schemes are initiated by the Government. The cumulative effect of legislative and other official provision is no doubt contributing to the impairing of the competitive powers of British industry. The Government should give pause to

these matters—looking first to allowing the utmost liberty to industry to restore itself to a fully competitive state.

One other matter which arises out of the coal strike—it is idle to call it a "lock out" as is the wont of the Miners' Federation and its supporters—is a motion which the Labour-Socialist Party have placed on the Order Paper of the House of Commons, and which is to be discussed to-day. It proposes that the Government shall be censured for all sorts of things that they ought not to have done in connection with the strike and their endeavours to bring about peace. Those gentlemen who are anxious to pillory the Government say nothing regarding the Executive of the Miners' Federation, and the things they ought to have done, but refused to do, notwithstanding the advice of the General Council of the Trade Union Congress. The Federation, through their policy, have done more injury to the country, to the miners, and to Trade Union interests than has ever been committed by any other industrial disturbance. Some of the more sober-minded in the Labour Party view the resolution with great misgiving. They fear it will provoke a revelation of the truth of the matter which will not be to the credit of labour leadership and policy. The motion, and probably the speeches in its support, will no doubt produce a full measure of ridicule from the country generally.

Gas Price Policy.

Enormous increases in the price of coal for gas making cannot be met without someone having to pay, and that someone is the gas consumer. Sooner or later he has to foot the bill. Generally speaking, the best policy is to charge an additional price for gas coincidently, or approximately so, with the higher cost of its production. But no hard-and-fast rule can be laid down on this head. Local circumstances and business-developing considerations may make it preferable to spread the increased cost over a longer period than that to which it rightly applies. But there should be very definite reasons for this course, because, if pursued, some people who have been consumers during the reign of the higher manufacturing costs may not be consumers during the whole term of the liquidation of the increased burden. New consumers may also be enrolled; and it is, unless to the general advantage, unfair that they should be called upon to pay a price for gas higher than would otherwise obtain to help to meet the expenses incurred in providing other people with gas prior to the date at which they became consumers. Moreover, as the price of coal recedes, people naturally, through being unaware of the internal affairs of a gas undertaking, expect that the price of gas will immediately fall from that which prevailed during the period of high-priced raw materials. Therefore, to adopt the policy of spreading over a distance into the future the increased cost of producing gas during such a time as we have experienced requires not only courage, but confidence in the fairness of public opinion.

The Directors of the Newcastle and Gateshead Gas Company have not raised the price of gas during the coal stoppage; and they do not intend to do so now. An announcement to this effect was made in a letter which Mr. T. P. Ridley, the Secretary and Commercial Manager, on behalf of the Directors, addressed to the City Council; and, on its reading, there was public acknowledgment by Sir George Lunn that all through the piece the Company have "played the game." What the Directors propose to do is to carry a portion of the loss to suspense account, to be liquidated next year out of the enhanced price of secondary products, and to meet the balance out of the reserve funds, which they hope to rehabilitate over a period of years. Such a course would not have been taken by them without very serious consideration. They know they would be justified in at once raising the price of gas commensurately with the losses occasioned by the coal stoppage; they know, too, that they are taking certain risks in adopting this policy. But they have gone deeper than the question of obtaining a quick financial balance. They have taken into consideration their position in the industrial life of Newcastle, Gateshead, and the district. They have lived through, and in the midst of, the great industrial depression which their area has been suffering not only through the coal stoppage, but in the ship-engineering industry; and, while realizing that they are taking an exceptional course, they believe that, by keeping down the price of gas, and gradually over a long period recouping the losses they have incurred, they will be doing something to assist in the early development of trade in the district. In other words, they see that the sooner there is industrial improvement, the better for the Company; and they have set this against any disadvantage there may be in having for a time the accumulated losses standing as a charge against future business.

There is great appreciation in Newcastle over the action of the Company; and, though their policy would not be the best in other circumstances, in the conditions of the area it is probable that it is the most politic. We hope there will not be short memories in Newcastle and the district; also that the future will prove the Directors were right at this time in their public-spirited decision—a decision arrived at (with due recognition of the risks) after full consideration of estimates and the needs of the supply area. It is valuable to know that such a directorate as the Company possess have determined to face the situation in this way. It speaks eloquently of their opinion regarding the future, both for gas supply and the country's industry and trade.

Vertical Retort and Other Tars.

The Tar Conference, to which extended reference was made in the "Journal" last week, did not result in anything of a very definite nature; but it was valuable (among other things) for its disclosure of the necessity for something positive being done to free us from the tangle in which, through various causes, tar problems are unfortunately involved. It is found that there are several individual workers making investigation into tar production, constitution, and application. They have been driven to this by the present-day variety of tar, by the diversity of requirement for tar, and by the attacks which have been made upon some descriptions of tars for both road purposes and the making of briquettes. The whole subject of tar appears to be in a state of flux. Opinions differ, and so do recommendations. There are many questions which want clearing up. It is no use postulating this and that; matters must be placed on a firm and concordant basis. To that end, of fundamental importance is the co-ordination or standardizing of the methods of testing tar and its constituents. A proposal was submitted by Dr. E. W. Smith, and was adopted, whereby a Joint Committee of the Fuel Section of the Society of Chemical Industry, the Coke-Oven Managers' Association, and the Institution of Gas Engineers is to be appointed to devise means for producing such standardization. The papers, taken in conjunction with the discussions, show that the sooner the Committee set to work, the better; and while they are engaged on it, they will perhaps take in hand the cognate subject suggested by Dr. W. B. Davidson—that of providing a road makers' test of the agglomerating, agglutinating, or conglomerating (whichever term is most appropriate) property of the material which coal carbonizers produce.

The discussion emphasized the fact that we are far from a settlement of the vexed question of the applicability of vertical retort tar for road purposes, and of pitch from the same source for briquette manufacture. There is a great deal that is contradictory about the statements made in this connection; but the question must be viewed in a practical way. The gas industry cannot afford vertical retort tar or pitch to be debarred from the ordinary markets. We have to remember that nearly half the coal carbonized by the gas industry—and the quantity is increasing almost daily—is being dealt with in vertical retorts. But there is evidence to show that vertical retort tar can be made suitable for road use, and that its pitch can be employed as a binder in briquette making. Moreover, vertical retort tar has qualities which appeal to the distillers. Making the tar suitable for road purposes is more or less a question of distillation; and the pitch for briquette production appears to be a matter of manipulation. As the old order of things changes in such a pro-

cess as carbonization, any attendant developments must, if necessary, be dealt with by directions realized from scientific investigation.

The specification for road tar which was submitted by Mr. W. Gordon Adam (in collaboration with Mr. H. W. Robinson, of the Midland Tar Distillers, Ltd., representing the British Road Tar Association) was attacked by the defenders of vertical retort tar on the ground that it was not sufficiently comprehensive, and that it would be difficult to produce from vertical tar road tars to comply with it. But it has been proved that good road tars can be made from the crude material. It would, therefore, be distinctly against the interests of the gas industry to have a specification introduced which does not comprehend the vertical retort product; and this shows the need for collaboration in drafting a specification which will cover coal tar whatever the system of carbonization. It was suggested during the discussion that a special specification was required to meet vertical tar; or one which would cover both vertical and horizontal retort tars. No reason exists why a specification of a composite nature should not be devised for embracing all coal tars. Another suggestion was that the specification, as put forward by Mr. Adam, would not be any better than the existing one, if tightened up. A matter also to be guarded against is that the specification must not be of such a character that it cuts out the preparation by simple plants of road tars at works situated a distance from tar distilleries, and in the locality where the prepared tar is required. Many such works are the very ones where all economies are needed to bring the net cost of gas down to the lowest possible level; and heavy transport expenses on tar to distilleries and from them to the roads in the neighbourhood of the gas-works are not a contribution to economy. Furthermore, unless those works are in a position to satisfy road surveyors in the matter of price, they will help to create and extend antipathy to the use of tar for road purposes. It was also advocated as advisable that a specific gravity limit should be set-up, otherwise a low specific gravity would admit low-temperature tars, which are known to be bad for road purposes. The danger of carburetted water-gas tar being mixed with other tar, and sent to the distillers, was mentioned by Mr. Adam. Such tar has no binding properties; and if it gets into the tar used for road purposes, it will have a detrimental effect. The question of tar acids, which (if they find their way into rivers and streams) are admitted to be hostile to fish and plant life, had prominence in the discussion; but it is submitted that these acids can be easily removed, and that they are not without profit to the distillers.

It is perfectly obvious that these tar problems are of such collective importance that they demand there shall be a pulling together between producers and distillers, in order to give the utmost value to tar, whether from horizontal or vertical retorts, so that the road makers and the briquette manufacturers can obtain what they want. At the same time, there should be eliminated from tar to be used on roads near fisheries the acids which are accused of being inimical to fish and plant life in our waterways.

A Voice from the Juniors.

An anonymous letter has been received, obviously from a junior member of the gas profession; and it has been prompted by our recent articles on "Where are the Students?" There is an excellent rule in connection with newspapers of all descriptions, that no publication shall be made in their "Correspondence" columns of letters which are not accompanied by the name and address of the writer—not necessarily for publication, but as a guarantee of good faith. The writer of the communication we have received signs himself "B. Just," and its object is an appeal to those responsible for the conduct of the industry to "be just" to the juniors—not in a few cases, but in all. The writer tells us he is deeply interested in the Education Scheme, and that he has written his letter in all sincerity. We believe him; and therefore we will, while declining to publish the letter in our "Correspondence" columns, utilize his points here, so that what he, as a junior, believes to be a fair complaint shall be brought prominently to the notice of those concerned.

The editorial articles, under the title of "Where are the Students?" have dealt with the question of the want of encouragement, owing to lack of students, to many important educational centres to set up classes under the Institution Education Scheme. We are sorry the evidence of this is irrefutable, for into the formulation of the scheme, and into the general organization of the machinery to give it effect, a great deal of devoted work has been put. We have pointed to the fact that there is this lack of students. The blame for it has not definitely been placed on any shoulders, though it has been hinted that there is confidence that more students would be forthcoming if the juniors of the industry were encouraged by their chiefs, and the administrations of the gas undertakings they serve, to enter upon the course of training involved by the scheme and the examinations. Our anonymous correspondent categorically asserts: "The industry "as a whole is not doing what it could do to encourage "its younger members." In those words, we detect personal experience, and a reason for the desire for anonymity. The short supply of students—in some areas no supply at all—is sufficient proof that the charge is justified.

The writer of the letter rightly submits that the provision of educational facilities is merely one part of the scheme; and no scheme can be perfect unless facilities are allowed to students to do their part. His exact words are: "The provision of educational facilities is not all "that is required; students require the facilities for at- "tending the course of instruction. Keen students in gas "engineering are to be found among the junior members "of some of the large companies, who require them to "do shift work, and give them no facilities for attending "recognized courses of instruction." We are sorry to find that the deeper this matter is probed, the more it is found that there is less reluctance on the part of juniors to enter upon a course of training which will increase knowledge and efficiency than there is on the part of those administratively responsible for the conduct of gas-works to grant facilities and to recognize successes. Perhaps this is due not so much to disinclination as to inappreciation; but the cure for inappreciation, we think, will be found by administrators of gas undertakings breaking away from their daily occupation with current circumstances, and spending a little time looking ahead and considering future requirements.

Our unknown correspondent, in the concluding part of his letter observes: "A successful student under the "Education Scheme should at least receive due acknow- "ledgment from the company he has the honour to serve, "and, if possible, some tangible recognition of his "efforts. The ignoring of this, in instances, may be "having some effect on the number of students now ap- "plying for admission to the courses of instruction. The "responsible men of gas undertakings must make a "special point of encouraging, and taking interest in the "studies of, their juniors, and seeing that they really get "facilities to attend courses, and obtain for them just "recognition of their successes." This can be readily endorsed and supported.

Testing Tar and Its Constituents.

It will be remembered that it was decided at the Tar Conference in Manchester that a Joint Committee should be appointed for the purpose of standardizing, as far as possible, the methods of testing tar and its constituents. The Joint Hon. Secretary (Dr. E. W. Smith), in a letter in our "Correspondence" columns, asks that all chemists and others who are interested in the subject of the standardization of methods of testing tar and its products should communicate to him information of the particular tests that they have in mind which require standardization. The Committee will then have a starting-point. They will also be put into communication with all those who are showing an interest in the subject, and will be in a better position to make a representative selection without serious omissions than if they depended on their own individual experience and knowledge.

Electricity Bill.

The House of Lords last week devoted the major part of two sittings in Committee to dealing with a large number of amendments which had been proposed to the Electricity Supply Bill. Little interest arises out of the proceedings, as the principal suggestions were either rejected or withdrawn, largely owing to the controlling power of the Government. As we are going to Press, the report stage of the Bill is being taken in the House; and therefore it is now close to entry on the Statute Book.

Our Foreign Fuel Imports.

"The Iron and Coal Trades Review" has published an interesting diagram, which indicates the course of our foreign trade in imports and exports of fuel during the seven months ended Oct. 30. From the information already published in our columns, readers have been made acquainted with the effect of the stoppage on fuel exports. Regarding imports of fuel, our contemporary states that these amounted to 622,900 tons in June, 2,358,500 tons in July, 4,059,700 tons in August, reached a maximum of 4,071,370 tons in September, and in October made a recession to 3,694,900 tons. The diagram shows that the average f.o.b. price of the total fuel imported gradually increased from 32s. per ton in June to 44s. per ton in October. Altogether, we have imported 14,814,302 tons of coal, coke, and patent fuel, costing £29,136,000. In October, we paid for 3,694,900 tons of imported fuel £8,178,307—a sum equivalent to about 9,200,000 tons at the average f.o.b. price prevailing last April.

Co-operative Coal Selling.

The reports of the Departmental Committee on co-operative coal selling have been issued. Views are divided on the question. By a majority of eight to three, the Committee are in favour of the principle. Their main conclusion is "the development of organized marketing in the coal-mining industry is desirable to avoid excessive competition, to effect economies and improvements in the marketing of coal, and to help stabilize the industry." This view is endorsed by the Chairman, Sir F. W. Lewis, Sir T. S. Catto, the Right Hon. Vernon Hartshorn, M.P., Sir Hugo Hirst, Sir Alfred Mond, M.P., Sir W. H. Peat, Mr. Frank Varley, M.P., and Mr. J. A. Warriner. The minority report is signed by Mr. J. R. D. Bell, Sir D. R. Llewellyn, and Mr. A. K. McCosh. Their conclusion is: "The system of free and open competition, under which the coal trade in this country reached the commanding position it occupied in the markets of the world before the war, is that which is best suited to its development in the future." Returning to the majority report, the Committee recommend that, where there is 75 p.ct. support of a scheme for co-operation, measures for making the scheme compulsory should be authorized. The Committee's view is that "Organized marketing is only immediately practicable in those localities and districts where there is a fairly general desire among the coal owners to develop it." The voluntary development of local arrangements—more particularly selling pools—among neighbouring colliery owners is advocated. It is considered that the co-ordination of district associations will be ultimately a desirable development, but can only be justified to the community by the industry effecting and sharing with the consumer economies not only in the marketing of coal, but in all phases of its production and transport. In the export trade, local selling pools and closer co-operation between colliery owners and exporters should be established.

Other Considerations.

It is the view of the majority that organized marketing is increasingly recognized as an effective method of avoiding excessive competition, of achieving economies and improvements in marketing, and of helping to stabilize an industry. In one form or another, it has been widely adopted in many other industries in this country, and in the coal-mining industry of Germany. But the want of consolidation in our coal industry is regarded as a serious impediment; and the advice is given that there should be amalgamations into a much smaller number of units. Regarding the question of no compulsion, Mr. Vernon Hartshorn and Mr. Frank Varley are not in agreement with the other majority members. They think it wrong that the opposition of the mass of the owners should be allowed permanently to deprive the industry and the workmen employed therein of the benefits which they are confident may be obtained by organization, and they therefore dissent from their colleagues' conclusion that they "are not prepared to contemplate anything in the nature of general compulsion." The two members making this exception recommend that the voluntary principle be first given a full trial, and that any legislation which may be proposed should be devoted primarily to assisting voluntary organization during a period of (say) two years. Thereafter, if no substantial progress has been made towards a general and co-ordinated system embracing the whole industry, then they think that the Board of Trade should have power to propose a scheme which, when settled after full investigation and consultation with the industry, should be imposed on all concerned.

The Minority View.

The three members who object to the principle of co-operative selling state: "Stripped of all the extraneous consideration by which the discussion of the matter is frequently confused, it is clear that the main objective of co-operative selling arrangements would be to compel the consumer to pay higher prices. Control of output is essential to the realization of this object. This policy of increase of price by way of limitation of output is diametrically opposed to the real need of the country and of its coal industry to-day—viz., a high rate of production at a low cost. The principles underlying the idea of co-operative selling are fundamentally unsound. The point of view involved must always be limitation rather than expansion of output; and the tendency must be to sterilize the development of the coal industry, hamper the expansion of industrial activity, and depress the standard of living all round."

Trade Union Law.

It is pretty certain now that the legislative programme for next session will include a Bill to amend the law relating to trade unions. A Committee of Ministers have been considering the subject for some time; and it is reported that their proposals are ready for consideration by the Government. It is not, of course, as yet known what will be the final form of the Bill. From public utterances on the subject, it is gathered that the Government are anxious to steer a course which—while restoring liberty to the workers, and removing the oppression upon them which has developed through modern trade union policy—in no way involves preventing trade unions carrying on their legitimate functions. Among the points which it is believed will be dealt with, is one to make it illegal for trade unions to call a general strike of the character of that experienced last May. Should such an action be taken, it is quite possible that the Bill will provide that the responsible leaders of the trade unions shall not have the right to claim immunity under the Trades Disputes Act. This would not affect an ordinary strike; but a national dislocation such as that of May last is something of a totally different order. The political levy is another sore point; and it is hoped that this will be dealt with by an alteration in the mode of procedure, whereby a member of a union will in future be required to indicate in writing his desire to contribute to the political fund, instead of, as now, having to sign a declaration that he does not wish to pay the levy. The grave abuse there has been of "peaceful picketing," it is hoped, will lead to more definite restrictions in this regard. It is suggested that they may take the form of a prohibition of mass picketing, and the picketing of the dwelling house of any worker who is regarded as a "blackleg." We may be fairly confident that the discussions in the House on the Bill will be of a somewhat lively character.

Falling Unemployment.

The Unemployment Exchanges on Nov. 22 recorded a total number of unemployed applicants of 1,514,700. This was 36,835 fewer than in the preceding week, but 340,155 more than a year ago. The total figure does not include those persons who ceased work in the coal mining industry on account of the dispute.

PERSONAL.

Mr. D. T. COLVIN, a Technical Assistant at the Blackburn Corporation Gas-Works at Greenbank, has secured an appointment as Chief Assistant to Mr. James Mitchell, at Nelson. Before his departure, a week ago, he received a handsome gold albert from the workmen, as a token of appreciation and regard. Mr. Colvin was formerly with Messrs. R. & J. Dempster, Ltd., of Manchester; and during the time he has been in Blackburn he has been under Mr. G. P. Mitchell, brother of his new Chief at Nelson.

During a social evening, in the Little Thurrock Parish Hall, at which between seventy and eighty employees of the Grays and Tilbury Gas Company were present, Mr. A. W. SUMNER (the Engineer and Manager) was presented with an inscribed silver salver, to mark the completion of 21 years' service with the Company, Mr. W. F. Whittaker (the Secretary), in making the presentation, said the whole of the employees had subscribed to the gift. Since Mr. Sumner joined the Company, the annual output of gas had risen from 48 to 247 million c.ft., and the number of consumers from 2246 to 12,400. Mr. Sumner was not only a highly esteemed colleague, but a close personal friend; and the wish of all was that he would continue his work among them, and enjoy long life, health, and happiness. Mr. Whittaker spoke of the deep sense of gratitude the employees felt towards Mr. Sumner, particularly for the inauguration of the Employees' Welfare Scheme. Mr. C. E. Harford-Roberts (Distribution Superintendent), Mr. J. H. Hornby (Assistant Engineer), and Mr. L. Hatt also made some congratulatory remarks; and Mr. Sumner, in thanking all for the handsome gift and the nice things that had been said about him, declared that it was only the loyalty of each and every one of the employees that had enabled the Company to carry on during the difficult time of the coal stoppage.

OBITUARY.

SYDNEY YARRELL SHOUBRIDGE.

It is with feelings of the deepest regret that we have to record the death of Mr. Sydney Yarrell Shoubridge, which took place suddenly on Dec. 2, at his home, "The Views," Carew Road, Eastbourne, after many years of good service to the gas industry, during which he had greatly endeared himself to those with whom he came in contact. Though for the past seven years he had been living in retirement at Eastbourne, where he was enjoying a well-earned rest from the daily duties connected with a gas undertaking, he maintained association with his old colleagues in the industry as an Hon. Auditor of the Institution of Gas Engineers, at the annual meetings of which he was a regular attendant—being as delighted to meet the members as they were to see him. Always kindly, courteous, and thoughtful for others, he will be affectionately remembered by those who had the good fortune to know him, and whose heartfelt sympathy will be extended to his widow and other relatives. His attributes were those which cannot fail to form and retain friendship.

Mr. Shoubridge, who was the fourth son of the late William Shoubridge, B.A., of Caius College, Cambridge, received his early training as a mechanical engineer as a pupil under Mr. Edward Hayes, of Stoney Stratford. Afterwards he was in the employ, at Middlesbrough, of Messrs. Hjerleid & Spence, and the Cleveland Bolt and Nut Company. Then he passed into the drawing office of Messrs. Westwood, Bailey, & Co., leaving that firm to become draughtsman to the Birmingham and Staffordshire Gas Company at the Saltley Works, Birmingham. Subsequently he became Resident Superintendent of these works—a position he retained for some years after the works were acquired by the Birmingham Corporation.

At the beginning of June, 1897, Mr. Shoubridge succeeded Mr. Charles Gandon as Engineer of the Crystal Palace District Gas-Works, at Lower Sydenham—which undertaking later became the South Suburban Gas Company, and absorbed the Bromley and Crays Gas Company, the West Kent Gas Company, and the Dartford Gas Company. With the South Suburban Gas Company he remained as Chief Engineer until his retirement in 1919, when Mr. John Terrace (then Manager of the Grimsby Gas Company) was appointed Chief Engineer. When selected for the position with the Crystal Palace District Gas Company, Mr. Shoubridge was Gas Engineer to the Salford Corporation, having gone there in 1888, shortly after the dismissal of Mr. Samuel Hunter. Previous to that time, he was, as already mentioned, with Mr. Henry Hack at the Saltley Gas-Works, Birmingham.

The retirement of Mr. Shoubridge after twenty-two years' service as Chief Engineer was marked by a dinner at the Trocadero Restaurant given by the engineering staff of the South Suburban Gas Company; and on that occasion he made reference to the great enlargement of the area of supply, and the extensions and reconstructions that had been carried out in connection with the various works during his long occupancy of his position. As a mark of their esteem and goodwill, the employees presented him with a silver centre piece, a pair of vases, and an artistically designed illuminated address; and the Directors gave him a silver tea and coffee service and tray. Later, a feeling by some of his old assistants and colleagues that they would not like Mr. Shoubridge to retire from active service without showing in some small way their very high appreciation of his many kindnesses to them personally, and also of his great help to the gas industry, resulted in another dinner at the Trocadero Restaurant, and the presentation to him of a small seventeenth century Italian bronze statuette. This testimonial was participated in by fourteen gentlemen who, at one time or another, had been either assistants to Mr. Shoubridge or connected with him on the engineering staff at Birmingham, Salford, and Lower Sydenham. They were: Messrs. J. W. Auchterlonie, L. G. Barber, Bretherton, F. Boardman, J. Bond, Kenneth Gandon, H. R. Garlick, Gregory, T. H. Hack, H. Kendrick, S. Meunier, J. W. Morrison, J. W. Whimster, and W. W. Woodward.

For the six years ending in 1913, Mr. Shoubridge was Hon. Secretary of the Institution of Gas Engineers. His retirement from that position, on account of pressure of other duties, took place in the Institution's jubilee year; and at the annual meeting, the President (Sir Corbet Woodall) presented him with a testimonial, in which the Council recorded their "high appreciation of the most valuable and devoted services rendered to the Institution" by Mr. Shoubridge, by whom the "duties appertaining to his office had been fulfilled with such unfailing courtesy and marked ability as to call forth the heartiest expressions of gratification, not only from the Council of the Institution, but from the members generally." The new Hon. Secretary was Mr. W. E. Price; and happily he still fills this office. In 1910, Mr. Shoubridge read a paper before the Institution on "De Brouwer Stoking Machinery and Coke Handling Plant;" the first De Brouwer coke conveyors used in this country having been installed at the South Suburban Gas-Works in 1899.

Mr. Shoubridge was elected a member of the Gas Institute as long ago as 1878; and he was also for many years a member of the Southern Association of Gas Engineers and Managers—rendering services which were acknowledged, on his retirement from active service, by his election as an honorary member.

The burial was on Monday last, in Eastbourne Cemetery, after service at Holy Trinity Church. At the funeral, the Institution of Gas Engineers were represented by Mr. John Terrace, Member of Council, and the South Suburban Gas Company by Mr. Terrace as Chief Engineer, Mr. W. Wastell (Secretary), and Mr. F. G. Gorman (Deputy Engineer).

ROBERT WILLIAM WILSON.

The news of the death of Robert William Wilson has aroused widespread regret both in England and on the Continent. Combining in a rare degree a great head and a great heart, he earned during his long and able business career the affection of all who were privileged to come in touch with him.

Such was his unwavering sense of duty and loyalty that he may be said to have consecrated his whole life to the prosperity of the Imperial Continental Gas Association and the happiness and well-being of all connected with it. His years of service with the Association numbered no less than 53. Of that period, 26 years were spent in the capacity of Secretary, and the last four as a member of the Board; and the Association bears the indelible impress of all that his great sense of humanity, his business acumen, and his capacity for organization gave to it. Even at stations which have long since passed out of the control of the Association, one cannot fail to be struck by the volume of evidence of his immense activity which remains.

His generous sense of sympathy was never appealed to in vain in a really deserving case; and there are few Englishmen, whose relations with the Continent have been primarily of a business character, the mere mention of whose names will unlock such a store of happy memories as that of Robert Wilson. No barrier, whether of nationality or language, was proof against his tact and sincerity. His strong sense of humanity and the traditional humanity of the Board of the Imperial Continental Gas Association reacted on each other; and the result was to build up an undertaking which was in some senses more akin to a brotherhood than to a commercial undertaking.

His outstanding ability, his great force of character, his unflinching loyalty, his courtliness, and his kindness of heart made up a personality the recollection of which will never fade from those who have been subject to its charm.

F. H. J.

The death occurred, at his residence in Didsbury, last Friday afternoon, of Mr. JAMES BOWDEN, representative of Messrs. Harold Nicholson & Co., Ltd., of 15, Victoria Buildings, Manchester, who had been with the Company since its inception. The shock of Mr. Bowden's death was all the greater from the fact that no one was aware that he was seriously ill. He was actively at business on Wednesday last, and was out of doors an hour or so before his death.

ELECTRICITY SUPPLY MEMORANDA.

With Christmas approaching, the question of Christmas gifts arises. The gas industry has not hitherto been much given to do as other tradesmen do—make special displays at Christmas time, and have "annual sales," at which, for the period of their run, concessions are made to buyers. Attention has recently been drawn in the "Journal" and "The Gas Salesman" to the success of the Newcastle and Gateshead Gas Company at its recent "annual sale," at which purchases, and hiring and hire-purchase contracts, were so great as to cause for a time a little embarrassment to the fitting department. Such embarrassment is not a bad thing to have to contemplate, particularly in such a notoriously efficient electricity supply area. Our electrical contemporaries, we see, are at the present time publishing articles describing small electric fires, irons, self-contained kettles, table cookers, shaving-pots, curling-irons, and numerous other sundries which they consider suitable for Christmas presents. We will admit that they have a larger range of goods than the gas industry can show of a nick-nack character, which can appropriately be given as Christmas gifts where the recipients have an electricity supply. Those gas undertakings that are not making the most of their showroom windows should try the effect of a Christmas present display; a very respectable assortment of goods can be staged—small fires for bedrooms, reflector heaters, irons, small water-heaters, kettles and other utensils suitable for gas-cooker use, pretty shades for gas fittings, &c. Make the showroom windows look bright at Christmas time, and demonstrate that the undertaking is prepared to trade as other traders. Make people talk about the showroom; it provides splendid advertising.

Christmas Utility Gifts.

Tender Care.

An electrician, writing in the "Women's Page" of the "Daily Telegraph" recently, on the subject of the "Care of Electrical Appliances," succeeded in showing—unintentionally, of course—that they are not so labour-saving as is generally postulated by their advocates. They need tender treatment and attention, compared with the household implements which they seek to disestablish. Carpet sweepers, polishers, and irons require more care than is usually bestowed upon brooms, dustpans, and irons of the non-electric house. A "fruitful source" of trouble is the connecting cord between the wall plug and the appliance. It is advisable to buy electric kettles, tea urns, shaving-pots, and similar heating utensils which are provided with a safety device to cut-off the current in the event of their boiling dry. "On a gas-ring or a coal fire, it is easy to see when the heat is being applied; but the invisibility of electricity sometimes leads to forgetfulness; and without this device, burnt-out utensils are likely to result at some time or other." As to labour-saving: "All apparatus should be kept well polished, so as to reduce the radiated heat to a minimum, and hot-plates should be kept scrupulously clean. In some of the older types of hot-plate, the wires are exposed; and if grease is allowed to splash over and remain upon them oxidation results, and the heating elements are quickly destroyed. This is now largely overcome by choosing hot-plates in which the wires are coated with, or embedded in, enamel; but even with these, cleanliness is essential if the best results are to be obtained."

The Wherefore.

The meteoric person who is responsible for the editorial notes in the "Electrical Times" has had a brain wave. He is thinking of making a list of towns where there are no gas-lamps left in the streets. Brighton, he says, has cleared out all but about a dozen of the gas "relics;" Hackney is qualifying for first place; and Sunderland claims that practically all the street lamps—approximately 3000—are electric. When, if ever, "Meteor" carries out his intention, he might mention in each case whether the municipal authority owns the electricity undertaking and private enterprise the gas undertaking. He might have supplementary compilations applying to areas in which both undertakings are municipal possessions, and to areas in which both the gas and electric supplies are run by private enterprise. He would thus accumulate a stock of information which would cause him to ask, Why the differences? Municipal ownership is a wonderful element in the choice of the street illuminant; and it also causes all factors in the public lighting problem to fall into the background, save the one that every scrap of business, no matter the expense and the result, must be obtained for the electricity concern. Perhaps it will interest "Meteor" to know that the statutory gas undertakings of the country sold for public lighting purposes 6,928,745,000 c.ft. in 1920, and 9,950,985,000 c.ft. in 1925—an increase of 43·6 p.ct. If he does not believe us, perhaps he will consult the Board of Trade Returns.

Gas-Works and Electricity.

Gas-works have a large experience of electricity generation and distribution about the works for the operation of their scattered plant and machines on intermittent service. Some of our electrical friends are of opinion that gas engineers do not know much about the business of electricity generation; and they are rather dubious regarding the ability of gas-works to generate as cheaply as they could be supplied from the town electric cables. Many gas-works, however, can show private plants and electrical costs which would be an object-lesson to manufacturers generally. The Burnley Corporation Electricity Department have had their eyes opened to a few facts regarding this matter. They were unbelievers in the Gas Department being able to beat them in respect of cost. New gas-works are being built at Old Hall, and the Gas Department prefer to have plant of their own for providing energy. The Electricity Department thought it was impracticable for the gas-works to generate at the low figure estimated. The Corporation consulted Mr. W. H. Patchell, Consulting Electrical Engineer of Westminster; and he reports that the scheme has been well conceived, and calculates that the cost of obtaining current from the Electricity Department would be 50 p.ct. greater than that at which the gas-works can generate it. Apart from cost, it is always preferable for a gas-works, relying so much upon mechanical operation, to have the provision of power supply under its own control, and not be exposed to the interruptions to which town systems—from generating plant through the lines of cable—are subject. The continuity of the supply of gas must have every available protection; and power generation *in situ* is a safeguard which is worth even more than the economy in cost which can be shown. Electricity generating plant on a gas-works (apart from the question of cheap fuel supply) eliminates many costs to which town generation and distribution are liable.

Low-Grade Fuel and Steam Raising.

A point that has frequently been made of late is that low-grade fuel can be employed at electricity generating stations for steam-raising, and thereby enable the electricity industry to do something to contribute to the conservation of our coal supply by using up material for which there is not a great market. The economy of doing this is a moot point, especially where the generating station is a considerable distance from the source of coal supply. The poorest of stuff which can be classified as fuel costs as much for conveyance as high grade; and more has to be used for a given output of steam. If the output of a steam-raising plant is reduced by the use of low-grade fuel, then it may be necessary to increase both the plant and the amount of labour to meet the steam requirements of the station. There are thus many considerations affecting the economy of the use of such fuel—unless it is employed in conjunction with coke, the combination supplying (in normal times) a good and economical fuel bed. London suffered much on Monday of last week, owing to the curtailment of its tube rail service and the slowing-down of the trains that did run. Lot's Road power station struck what is described as a "bad patch" of foreign coal, with the result that steam production fell off alarmingly; and it was therefore impossible to generate the amount of energy needed. The experience has its lessons for electrical engineers.

The Erring Light.

The antipathy of electricity to evening shopping and amusements and to public worship on Sunday has been demonstrated over and over again. Tavistock had an experience of this on a Sunday towards the end of November. While evening service was proceeding, there was a breakdown of current; and the "Western Evening Herald" states that "many services had to be conducted by the dim glow of candle light." The report also tells us that it was soon after six o'clock when it was noticed that the lights, both in private houses and in the streets, were "burning dim;" and when the church services were at their height, the illumination disappeared altogether. Some of the churches were fortunate in having their gas supply still available, and were thus unaffected by the failure of the electricity supply. In other places, the primitive candle was called upon to do duty in the absence of its erring fellow illuminant. The electric light failed last Wednesday in the Preston Sessions House; and business for a period had to be conducted by candle light. There was trouble at Huddersfield on Nov. 29, owing to a breakdown.

Obstacles in the Path.

The heading given by the "Electrical Review" to an abstract of the address of the Chairman (Mr. W. G. Heath) to the Western Centre of the Institution of Electrical Engineers is "The Universal Application of Electricity." That word "universal" is enough to give one a bad shock. We look round at the gas industry—robust and growing, money being expended in large extensions, policies being shaped to meet the demands of the future, and to strengthen the competitive position. But what is the good of it all, if electricity is to become "universal?" But the universality of electricity is all a dream—a disturbed state of the mind, or an idle fancy—which can never be realized while the best electricity can do is to bring to book 18 p.ct. of the thermal value of the fuel it uses, and while the costs and losses

of the most efficient distribution of the current remains so high. We hardly think that Mr. Heath selected the "Universal Application" title; it may have been an unhappy idea of a member of the "Review" staff. Why we think this is that the address is composed largely of a series of complaints regarding obstacles to universality. The price of domestic power and heating, Mr. Heath says, is far too high; and he attributes this mainly to the fact that members of electricity committees like to plume themselves at re-election times on the electricity undertaking's contributions to the relief of the rates. But that does not apply to company undertakings. Then the cost of electric appliances is far too high. Whether or not the cost of a thing is too high has relation to two things—the cost of competing appliances, and whether the heavily-priced appliance renders such duty as to produce a greater economy in use than the lower-priced competing appliance. Unfortunately for electricity, economy and reliability are with the competing appliance. In this connection, Mr. Heath suggests a piece of unsound finance. He looks forward to the time when electricity authorities will be content to split up the financial charges associated with the hire, maintenance, and depreciation of such domestic appliances by debiting one-half of them to the apparatus and the other half to the charge per KW.-H. Perhaps he will find the wiring and selling clause in the Electricity Supply Bill an obstacle to this being done. He is also painfully conscious of the fact that, in spite of numerous regulations, an "enormous amount" of jerry installation work is being carried out to-day. This is a disadvantage; as are also the reports of fires having been electrically caused. Probably these reports are true, having regard to the jerry installation work. He further urges a greater measure of standardization of appliances, and more attention to the training of apprentices. We do not see much in the address to warrant any idea of the approach of electrical universality.

Col. Crompton Dubious.

Although the Government Electricity Bill is almost on the Statute Book, it is interesting to have the views of such a distinguished Electrical Engineer as Col. R. E. Crompton on the subject of the prospects of the Government scheme resulting in the national benefits which its sponsors have promised. An article contributed to "The Engineer" by him commences with almost a touch of sarcasm. "When," he says, "the Prime Minister stated that he was about to introduce a Bill which would cheapen electric supply, and put it in the power of the humblest to have all its advantages, we who had devoted our lives to developing electrical energy felt complimented and pleased." In his opinion, the Bill dwells far too much on the advantages of using fewer large generating stations interconnected by what is called the grid, which will make great reductions in the generating cost. Although it is undoubtedly true that from the nature of things both the private companies and local authorities who have established a large number of local generating stations of small size have been compelled to charge what appears to be a high price to the user, this is not chiefly due to high generating cost, but in most cases to the character of the demand, which up to the present has been so largely for lighting. It follows that the overhead charges, which must be met, whether the scale of production is small or large, have to be divided over a comparatively small number of hours of use per annum. It is this low load factor, common to all the smaller distributing centres, where supply is mainly for lighting, that entails a high price—in fact, a price prohibitive to any but the wealthier classes. Wherever in England and Scotland it has been found possible to reduce the total cost and hence the price to the consumer to a low figure, it will be found that this is in the districts where power is extensively used for industrial purposes; and there the average price charged for lighting and power is already as low as in any country in the world where electrical energy is obtained from coal. When the Bill was introduced, the enthusiasts believed that the Government would give aid to supplying the rural districts of England at a cheap rate. There is no sign of this in the Bill as it now stands. The authority which is to be set up has no power to assist this rural development, however much it may desire to do so. It is only authorized to raise money for improving or enlarging existing generating centres, and making them more efficient as such, and to add on to the cost of generation that of constructing and maintaining a vast system of interconnecting mains, "about which none of us have sufficient information to enable us to say whether the overhead charges on these interconnecting mains will not increase rather than lower the selling price." Another point made by Col. Crompton is that in the Bill not a word is said about the incidence of local taxation. The works of most of the London Companies are assessed in such a manner that the charge for rates, worked out per unit sold, is in many cases higher than the present coal Bill.

NOTES ON NEW BOOKS.

"HOME FIRES WITHOUT SMOKE."*

This excellent book, edited by Cyril Elliot and Marian Fitzgerald, is divided into four chapters, each dealing with a particular aspect of the problem of smoke abolition. In the first chapter, written by Dr. Margaret Fishenden, the proper use of solid fuels—particularly, of course, smokeless fuels—is discussed. Chapter II. is by F. W. Goodenough, C.B.E., and has as its title "Gas in Relation to Smoke Prevention;" and the next is concerned with electricity, and is contributed by F. H. Masters, O.B.E., with an introduction by C. Haslett. The final chapter, by Sydney M. Bushell and Catherine Gordon, tackles the problem from the housewife's point of view. All these contributors are experts, and well fitted by experience to pronounce authoritative opinions.

There is a foreword to the volume by Sir Napier Shaw, who appears to be unduly perplexed as to how gas-works practice can afford an adequate solution to the evil of smoke. He tells us that about forty million tons of coal are burned in domestic fireplaces every year, and that if this enormous quantity was carbonized at the gas-works, there would be an enormous surplus of gas. He goes so far as to say that "it will take a hero as man of gas to tell us how to do it (*i.e.*, dispose of it), for one cannot sell gas over the counter in paper bags." Of course, there is no need to replace entirely by solid fuel of a smokeless nature the forty million tons of coal now burned in the home. Gas, as its use becomes more extensive, is bound to be cheaper; and the domestic work now performed by coal will be divided between gas and coke. Probably less than half the forty million tons of coal now consumed in the raw state would, if split up into gas and coke—and this division, thanks to complete gasification, steaming, &c., can be in any desired proportions—fill the bill and help to conserve the national fuel resources. We will indulge for a moment in a few figures. A ton of coal, when burned in the domestic grate, is good for 6 million B.Th.U. of useful heating. The same ton, if subjected to complete gasification, would yield about 20 million B.Th.U. Of this, at least 14 million B.Th.U. would be useful heating. In other words, it would be necessary to gasify only 10 cwt. of coal to obtain the same heating effects, through gas, as are obtained by burning 1 ton of coal in the raw state. Hence we see no necessity for a hero if the gas is sold cheaply.

In the first chapter Dr. Fishenden expresses surprise that the use of gas coke for domestic heating in the open hearth has not become more general. If, she says, householders could be induced to give it a fair trial in their sitting-room grates, there is little doubt that many of them would adopt it permanently. It has a relatively high efficiency, is relatively cheap, and emits no smoke. Dr. Fishenden remarks that, in open ranges, such as those commonly used in Lancashire and Yorkshire, if the fire bed extends below the bottom of the oven, coke is as efficient as coal for cooking purposes. Indeed, coke often behaves satisfactorily for oven heating in open ranges when the fire bed does not extend below the oven, and when advantage is not taken of direct radiation from the fuel. It frequently also heats the water in the saddle boiler behind such ranges as well as, or better than, coal. "Thus," she maintains, "in numerous kitchens coke could be substituted for coal with considerable advantage to the user, who would thereby be saved from the inconvenience of frequent chimney sweeping, and would be contributing towards the elimination of smoke and fog."

In Chapter II. the author mentions as one of the necessary properties of any substitute for coal that of reliability. In this connection he records the interesting fact that the largest undertaking in the world—the Gas Light and Coke Company—has supplied gas since 1812 without a single failure. After reading this admirably written chapter, one is once again impressed by the fact that the claims of gas need no overstatement.

In "Electricity and Smoke Prevention"—Chapter III.—Mr. Masters contends that "electricity for a particular purpose may release as useful work the whole of the energy registered on the meter." The "100 p.ct. claim" is, of course, a fallacy. If we were compiling a dictionary, we should define the term optimist as a man who expects to obtain 100 p.ct. efficiency from an electric appliance, and the term scientist as a man who realizes that he will not get this 100 p.ct. Electricity is an essential to modern existence; but this does not imply that it has no fault. Electricians would be wise to bear in mind that, if their milkman told them that the milk he supplied was very old brandy, they would not drink more milk.

* "Home Fires without Smoke," edited by C. Elliot and M. Fitzgerald. Published by Ernest Benn, Ltd.; price, 3s. 6d. net.

RESEARCH WORK AT BIRMINGHAM UNIVERSITY.

A coal treatment laboratory for research of a varied kind (much of it of direct interest to the chemist and chemical engineer), which represents an important addition to the Mining Department of the Birmingham University, was formally opened by Viscount Chelmsford, Chairman of the Central Committee of the Miners' Welfare Fund, on Thursday, Nov. 25. Sir Gilbert Barling, Bart. (Vice-Chancellor of the University), presided; and among those present were Colonel Lane-Fox, M.P. (Secretary for Mines), Prof. K. Neville Moss (Head of the University Mining Department), Prof. J. S. Haldane, Mr. Frank Hodges (International Miners' Federation), and several members of the National Fuel and Power Committee.

The laboratory, which has to do largely with coal treatment, has been inaugurated to enable the Mining Department of the University to extend its research activities into that side of mining technology embracing operations of grading, cleaning, and classifying the raw product. Funds amounting to £9400 have been provided for the construction and equipment of the laboratory by the Miners' Welfare Fund. The utilization of cleaned smalls will be studied in a briquette plant, where experiments will be made in blending coals, on the variation of pressure and its effects on briquette coherence, and the suitability of different binding agents. Laboratory research upon colloidal fuel (a mixture of powdered coal and fuel oil) will be carried out; and if a suitable process can be devised, experimental plant will be erected in conjunction with the existing boiler plant.

The equipment includes a pulverized fuel plant. Coal to be used in this unit is delivered into a bucket elevator at yard level, and raised to a storage bin on the roof of the laboratory. It is drawn from this into a dryer heated by boiler flue gases, and, when moisture has been sufficiently reduced, passes over a magnetic separator to the pulverizing mill. The latter reduces the coal to a fine dust, which can be handled almost as a fluid. The dust is passed to a weighing machine, and thence to a special pump, which elevates it to the pulverized coal bin. From this it is fed automatically to the burners of the boiler. This arrangement has several disadvantages; and it is proposed to change the order of operations by rearranging the plant.

Combustion conditions are continuously recorded by a "Duplex-Mono" CO_2 and CO recorder mounted on an instrument panel, which also carries a Kent flow meter recording on a chart the steam output from the boiler. Provision is made for metering the water supply to the boiler. An optical pyrometer is available for measuring furnace temperatures, and a recording pyrometer is mounted on the instrument board for measuring the temperature of the flue gases at different points. Complete data may thus be obtained for an exhaustive series of tests on the utilization of powdered fuel in a boiler of modern design.

A plant has been designed to produce rectangular briquettes from coal of ½ in. and downwards. The coal and binding material are intimately mixed on a concrete floor, and then loaded into a small elevator. This discharges into a vertical heater in which steam is passed through the mixture, to soften the binder. The semi-plastic material is then fed to a press, where it is subjected to heavy pressure. The finished briquettes are automatically pushed from the moulds on to a belt conveyor, where they cool down sufficiently to allow of stacking them at the further end. The pressure to which the briquette is subjected may be varied by adjusting the press, so that coherence tests may be performed and the best pressure ascertained for any sample of raw material.

JOINT COUNCIL OF THE JUNIOR GAS ASSOCIATIONS.

A meeting of the British Junior Gas Associations Joint Council was held in Manchester, on Nov. 24, under the Chairmanship of Mr. W. H. BATTERSBY, the President of the Manchester and District Association. The delegates present were: Messrs. A. Broadbent, Leonard Lacey, and W. L. Westbrook (London and Southern Association); F. B. Small, J. Alsop, and I. H. Massey (Manchester and District Association); C. F. Tooby, H. R. Hems, and W. L. S. Spinks (Midland Association); T. V. Blake (Wales and Monmouthshire Association); S. T. Musgrove, C. H. Chester, and H. Wilde (Yorkshire Association); T. B. Armitage, and G. C. Gunston (Western Association); and B. J. Bell, Hon. Secretary and Treasurer of the Joint Council.

The CHAIRMAN, on behalf of the Manchester Association, welcomed the delegates, and mentioned that they had two gentlemen present from the recently formed Western Association.

The formal business of the meeting was then proceeded with. The minutes of the last meeting were duly confirmed, and Secretary's report and balance-sheet read and adopted. In the absence of Mr. J. Bridge, one of the Council's representatives on the Advisory Board, Mr. W. J. PICKERING read the joint report of the work done since the last meeting. A spirited discussion followed, in which the Education Scheme of the Institution of Gas Engineers was reviewed, and several points were raised, including the recent correspondence in the "GAS JOURNAL."

The facts elucidated were duly noted by Mr. Pickering, who promised to bring forward the matter at an early opportunity.

A vote of thanks was passed to Mr. Bridge and Mr. Pickering for the valuable work they have done for education in general, and for their services to the Joint Council in particular; and they were unanimously asked to continue their work as representatives of the Joint Council.

The application of the Western Junior Association for affiliation to the Joint Council was received, and pleasure expressed at the formation of the new body. Mr. Gunston gave a résumé of the activities of that Association up to the present; and on the motion of Mr. BROADBENT, seconded by Mr. ALSOP, the request for affiliation was unanimously granted.

Mr. BROADBENT reported an alteration of the rules of the London and Southern Association, which brought the qualifications for membership into line with the requirements of the Education Scheme.

The alteration was duly accepted by the Joint Council, though it was pointed out that the London and Southern Association were fortunate in being able to insist upon such high qualification for membership, as in other districts it would have a deleterious effect. Several of the Associations catered for men in the industry who did not possess such high qualifications; and it was agreed that no attempt should be made to adopt eliminating clauses generally.

Other items on the agenda included questions regarding Press reports, life membership, and important domestic matters brought forward by the Associations.

At the conclusion, a hearty vote of thanks was accorded the Chairman for his admirable conduct at the meeting, and also for auditing the Joint Council accounts; and the Manchester Association were congratulated upon, and thanked for, the admirable arrangements they had made, and the hospitality extended to members on the occasion of the visit. With this vote, the names of Mr. Alsop and Mr. Massey were coupled.

Mr. TOOBY, on behalf of the Midland Association, extended an invitation for the next meeting to be held in Birmingham; and this was agreed to.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

A meeting of the Association was held at the Grand Hotel, Birmingham, last Thursday—Mr. F. C. BRIGGS, of Dudley (the President), in the chair. The meeting was convened for the purpose of transacting certain formal business; general meetings having been abandoned, owing to coal strike conditions.

Reference was made to the death of Mr. J. S. Cranmer, of Stratford-on-Avon, a highly respected honorary member of many years' standing.

Members were unanimous in re-electing all officers for a further twelve months.

President.—Mr. F. C. Briggs, of Dudley.
Vice-President.—Mr. W. G. S. Cranmer, of Willenhall.

The following were duly elected to membership:
Mr. Alfred J. Gould, of Kington.
Mr. Arthur Reg. Jubb, of Melton Mowbray.
Mr. Jno. H. Paterson, of Ludlow.

Certificates were presented to successful candidates in the Higher Grade Examinations in Gas Engineering and Gas Supply:
Mr. F. C. Sylvester, of West Bromwich—First Class, Gas Engineering, with distinction.
Mr. J. R. Taylor, of Coseley—First Class, Gas Engineering.
Mr. J. E. V. Caesar, of King's Norton—Second Class, Gas Supply.
Mr. F. L. Atkin, of King's Norton—Second Class, Gas Supply.

The PRESIDENT, in presenting the Certificates, congratulated the recipients on their success, and in some interesting remarks spoke of the standard he would like to see attained and recognized in the gas profession in the near future.

FURTHER PAPERS AT THE TAR CONFERENCE.

COLLEGE OF TECHNOLOGY, MANCHESTER—NOV. 26.

[For report of proceedings at the Afternoon and Evening Sessions, see last week's issue of the "Journal."]

Prof. ARTHUR SMITHELLS, F.R.S., Chairman of the Fuel Section of the Society of Chemical Industry, presided at the morning session, when the papers read and discussed included the two from which the following extracts are taken. In addition to these, two papers were presented by Mr. H. M. Spiers, M.A., B.Sc., F.I.C., of the Research Section of the Woodall-Duckham Companies—one on "The Variation of the Hutchinson Consistency of Tars with Temperature," and the other on "The Consistency of 'Bitumen Mixtures.'"

A STUDY OF THE TARS AND OILS PRODUCED FROM COAL.—PART II.

By F. S. SINNATT, J. G. KING, and W. H. LINNELL.

[Extract.]

The main object of this paper is to put on record the present stage of the investigations in which we are directly interested. These investigations consist broadly of the determination of the effect on the composition of low-temperature tar of the nature of the process of carbonization and of the coal used.

INFLUENCE OF TEMPERATURE OF CARBONIZATION ON A MEDIUM CAKING COAL.

(1) The yield of tar increases to a maximum at 550° C., and then decreases steadily. The yield at this temperature is 17·65 gallons per ton of coal, and 67·7 p.ct. of that obtained in the Gray-King assay.

(2) The net yield of aqueous distillate, excluding that derived from the moisture contained in the coal, increases at first, and then remains approximately constant.

(3) The specific gravity of the tar increases steadily with increasing temperature of carbonization, but above 550° the increase appears to be accelerated.

There appears to be definite evidence of the fact that an external carbonizing temperature of 550° is a critical one in the carbonization of this coal. Though it cannot be said that the products obtained up to this point are "primary" ones, there is reason to believe that above 550° secondary decomposition begins with the effect of increasing the gas yield at the expense of the tar, the latter becoming denser and more viscous.

In the detailed examination of the series of tars, it was found that definite changes in character could be detected in the tars produced above 550°.

TREND OF MAJOR VARIATIONS.

(1) The lighter fractions, up to 230°, increase in amount to a maximum at a carbonizing temperature of 500°. Above 500° they decrease, at first rapidly and later more slowly.

(2) The middle fraction (234° to 277°) increases rapidly in amount to a maximum at the same temperature, and then decreases.

(3) The corresponding variations, viewed as percentages of the tar, are not so marked.

(4) The amount of the highest fraction increases even more rapidly than the middle fraction, but does not reach a maximum before a carbonizing temperature of 550°.

(5) The above changes are accompanied by continuous increases in the amount of pitch, but with a marked acceleration in pitch formation as the carbonizing temperature rises from 500° to 550°. In this connection it may be stated that the distillation of each tar was continued up to the point where decomposition commenced. The point at which this occurred with the 400° tar was 345°; and with the 650° and 700° tars, 325° and 330° respectively. The remaining tars were distilled to 360°.

The evidence obtained during the carbonization of the coal pointed to the fact that 550° was a critical temperature; but from the preliminary examination of the tar, it would seem that the changes detected had already commenced at 500°.

DISTILLATION FRACTIONS.

The weights of the fractions obtained by the distillation of (*a*) the crude oils, (*b*) the neutral oils, and (*c*) the saturated oils may be summarized as follows:

(1) The removal of the relatively large proportion of phenols from the middle fractions increases the proportion of the lighter fraction in the neutral and saturated oils. The effect is similar for all the oils; and the middle fractions are correspondingly reduced.

(2) The residues remaining after the final temperature of 354° is reached are approximately the same in each case for the crude and neutral oils. The proportions are about 5 p.ct. and 9 p.ct. for the 400° and 450° oils, rising to a maximum of about 15 p.ct. for the 550° and 600°, and decreasing again to 9 p.ct. and 5 p.ct. for the 650° and 700° oils. The residue obtained when the saturated oils are distilled is considerably greater, but shows the same variations, rising from 16 p.ct. in the 400° oil to a maximum of 30 p.ct. in the 600° oil, and falling again to 20 p.ct. in the 700° oil.

These variations again point to the fact that 550° to 600° is a critical carbonizing temperature.

HYDROGENATION OF COAL.

The study of the liquid products obtained by the hydrogenation of coal has not yet been brought to a stage when any complete results may be published. The experiments in the small-scale plant have been continued. It is certain that from 50 to 60 p.ct. of our average British bituminous coal may be converted into liquid hydrocarbons, while about 15 to 20 p.ct. is converted into gas, and about 10 p.ct. of solid organic matter remains as a residue.

The light oil contains benzene, toluene, and xylene, and in this respect differs markedly from those produced by low-temperature carbonization.

Mr. SINNATT, in some additional remarks, suggested that the interest shown in the subject of tar was a clear indication that it would be necessary to have a Tar Section of the Fuel Section of the Society of Chemical Industry. Speaking with regard to the investigation of which details are given in the paper, he said that half of the investigation was being carried out at the Chemical Research Laboratories at Teddington, under Prof. G. T. Morgan, who had charge of the chemical aspects of the problem, while the more practical aspects were being dealt with at the Fuel Research Station at Greenwich. The plan adopted was to take 200 lbs. as the unit of coal carbonized, as it was thought, under uniform conditions; and the tests were repeated to try to get increasing quantities of tar. Carbonization was carried out in a special retort at the Fuel Research Station; and while it was believed that the general details were sound, he would welcome criticism. Regarding the yields of the products, he called special attention to two temperatures of carbonization—namely, 500° and 550° C. It appeared that something vital happened to the medium caking coal at 550° C. The expression "aqueous distillate" had been used in the paper, for a particular reason. In the first instance, it was thought that "ammonia liquor" should be used, because most gas-works people employed this term. But the first three distillates were strongly acid, and consequently could not well be called ammonia liquor. Between 500° and 550° C. there seemed to be a point where the liquid became neutral. The acid was hydrochloric; and this fact was of interest, because it must influence the people who were constructing plant as to the kind of metal they would use if the temperature of carbonization predominating in their principal systems lay below 500° C. The liquid at 450° C. contained a considerable percentage of iron dissolved from the condensing system at the Fuel Research Station.

With regard to the solid product obtained, the aim of the process was to make a robust smokeless fuel. The product at 400° C. was a robust coke; but as the temperature rose, it increased in strength, and this was an important commercial factor. At 700° C. the coke showed internal fracture—*i.e.*, instead of being a solid piece from the retort, it came out broken.

The pitch, which was of great interest, showed remarkable changes; and it was desirable to emphasize one particular feature—namely, that at a temperature of about 600° to 650° C., the pitch produced on distillation was extremely brittle. This was rather a difficult term to define; but when the pitch was run out of the still into trays, and allowed to stand, it burst open, and could be crumbled to an extremely fine powder in the hand. The pitch became more and more plastic as the temperature went up, and it became increasingly robust as the temperature decreased. At 600° to 650°, it was fragile. This temperature had been used widely in systems of low-temperature carbonization; and the general impression was that pitch from low-temperature carbonization was brittle, and therefore useless. It appeared from the results given in the paper, however, that the authors had found a critical value for carbonizing temperatures, which was unsuitable.

A PLEA FOR STANDARDIZATION OF ANALYTICAL METHODS IN COAL TAR PRODUCTS SPECIFICATIONS.

By W. GORDON ADAM, B.A., M.I.Chem.E.

Although the desirability of rigidly standardizing the methods of analysis of metallic and inorganic products may

be debatable, its necessity can hardly be denied in the case of organic commercial products, the valuation of which is almost invariably carried out by the observation of physical properties rather than by true chemical analysis. This has been recognized in the petroleum industry; but unfortunately few methods of testing coal tar products are properly standardized. Many of the large buyers have their own specifications, often many years old; and the situation is further complicated by the fact that two of the principal products—viz., creosote oil and pitch—are largely exported.

The four chief methods employed in the examination of coal tar products are the observation of (*a*) boiling points or distillation ranges; (*b*) crystallization or setting points; (*c*) melting or softening points; and (*d*) specific gravity—the determination of this property calling for no comment.

In some few cases fractionation is used, while in others *e.g.*, the determination of *m*-cresol and anthracene—true analytical methods are employed. For many years the vessel universally adopted for the determination of boiling points and distillation ranges was a glass retort fitted with a thermometer, the bottom of the bulb of which was placed at a specified short distance ($\frac{3}{8}$ to $\frac{1}{2}$ in.) from the bottom of the retort. With volatile liquids, such as benzole, toluole, &c., a water-cooled Liebig's condenser was connected to the retort; with products such as creosote, the neck of the retort was the only condensing arrangement used. Throughout the whole of the distillation, the thermometer bulb remained immersed in the liquid.

The use of retorts is open to very grave criticism. They are difficult vessels to blow to standard size or shape; and it is suggested that this form of apparatus should be discarded, the vessel to be used being a standard distilling flask. To facilitate matters, the standard Engler flask used in the petroleum industry, and adopted to some extent by the "B.E.S.A.," might well be used. Other matters requiring attention are the methods of heating and the thermometers employed. Different methods of supporting the distillation vessel are in use—*e.g.*, wire gauze, uralite, asbestos, &c.—variation of which will be found to have an appreciable effect on distillation range; and it is suggested that all heating should be done by means of a small naked flame, no wire gauze or other support to the bottom of the flask being used.

It is further suggested that in all cases where water is simply an adventitious impurity—such as with benzole, creosote, green oil, &c.—the distillation should be carried out on the dried sample, the percentage of water in the product being separately determined. Experience has shown that the size of thermometer bulb, material of the stem, &c., cause variation in readings; and it is suggested that for each range of temperature a standard type of thermometer should be specified. The amount of correction for exposed stem for temperatures above 200° C. is considerable; but it will be found that specifications often make no mention of this point. It is evident that the use of a standard flask giving a standard immersion of thermometer stem will facilitate more correct reading of the thermometer.

Sampling, no less than testing, requires standardizing, and it is essential that definite methods of sampling coal tar products should be laid down, although it must be admitted that in certain cases—*e.g.*, pitch—there are many difficulties to be overcome.

The greater part of the road tar manufactured is examined according to the Ministry of Transport specification, in which analytical details are reasonably closely defined. The material of the flask should, however, be restricted to glass, and the quantity distilled might be more closely specified. A metal flask has been employed by some chemists, but has been found to give different results from those obtained with glass. No mention is made in the specification as to the correction of the thermometers for exposed stem. The type of thermometer should be specified explicitly; for, as above stated, at 270° and 300° C. the corrections for exposed stem are considerable.

It has to be recognized that many methods of testing these materials in different countries have been in use many years; and all existing records would be of little value if entirely new methods were universally adopted. We should, therefore, standardize existing methods, rather than introduce entirely new ones.

Discussion.

Prof. G. T. Morgan, who opened the discussion, said that reference had been made by Mr. Sinnatt to the collaboration now going on between the Fuel Research Station and the Chemical Research Laboratory at Teddington. The work at Teddington had only been in progress for about ten months, and at present only a small staff was available. The pure chemical work was being carried out by Dr. Pratt, and the bio-chemical side of it by Dr. Barnes. Investigation had so far been confined to the higher fractions of the oils from the tars. With reference to the major constituents, attention had been directed to the phenolic substances, which were evidently complicated, because, in addition to such simple substances as the cresols and xylonols, there were phenols of unknown constitution.

Mr. T. Westthorp (Works Chemist, Consett Iron Works) said that Mr. Adams had not dealt with one or two tests which were of extreme importance, particularly the test for rectification of oil. Could Mr. Adams give them information on any important test other than the one now in use—namely, shaking with sulphuric acid? His own view was that such a test was anything but a measure of the degree of rectification for a satisfactory motor spirit. He was aware of a method which was said to be an improvement—and which he agreed was some improvement, but which in his opinion was not satisfactory—namely, Dr. Colman's test, in which he used potassium permanganate to oxidize such substances as would oxidize, and found out how much oxygen had been used; this being taken as a comparative index of the degree of rectification. Another point of importance was the question of free sulphur; and he would like information of how this free sulphur came to be present, and of a means of definitely measuring it. He was aware of Dr. Ormandy's copper strip method; but this was certainly no true measure of the free sulphur present in a motor spirit.

Mr. Biddulph Smith (Coke Oven Manager, Messrs. Dorman, Long, & Co.), referring to a statement in Mr. Sinnatt's paper regarding the disappearance of the paraffins from the oils obtained when coal was carbonized above 600°, said that some experiments which he himself had carried out a short time ago might throw light on the matter. He passed into the coke oven, through the charge of carbonizing coal, a pipe by which he was able to draw out the vapours permeating the tar zone in the core of the charge. He obtained a mixture of oils and aqueous liquor in proportions varying according to the stage of the distillation itself or the proximity with which the plastic layers approached the point of extraction. The oils when clarified, and separated from the liquor, were found to contain between 14 and 15 p.ct. of true paraffins, which were rectified. Seven liquid and six solid paraffins were isolated and identified; and they ranged from nonane down to tricosane. If Mr. Sinnatt would carry his experiments further, he would find more than one paraffin wax. In his own case he had recovered six separate solid paraffin compounds. He had come to the conclusion that, in practically every kind of carbonizing chamber, with perhaps the exception of the continuous vertical retort, carbonization proceeded from every face, so that the oils, in passing out of a charge of coal, had to pass through a zone of temperature higher than the point of origin. He had tried to find out exactly what the critical temperature was at which these oils decomposed. For this purpose he had taken a silica tube, closed at one end, and packed with small particles of graded coke. At the closed end was placed a small glass bomb filled with a definite quantity of oils extracted by applying heat to the end of the tube. The bomb was broken, and the oils vaporized and passed through this mass of small coke, which was heated to various temperatures. It was found that, up to 550° C., while the oils were cracked, the products having perhaps a lower molecular structure, the paraffins, continued about the same percentage in the condensed vapours after they had run the gauntlet of the hot coke. Above 550° C., however, the paraffins rapidly disappeared. This seemed to confirm the work done by Mr. Sinnatt and his colleagues.

Gray-King Test.

Dr. W. B. Davidson said he wished to draw attention to the unsatisfactory nature of the Gray-King test for tars and tar oils obtained by low-temperature carbonization. The method of evaluating a coal for low-temperature carbonization was to carry out the test and deduct a matter of 40 p.ct. or so. On the face of it, this was not satisfactory. In his own experience with low-temperature carbonization, when he got a new coal which had to be evaluated, he did not think of applying this test. The test he adopted was with a much larger apparatus, which would give sufficient tar to enable the distillation test to be made; and it was found that such a test agreed much more closely with the works test carried out on a big scale. It was also very necessary—and there was a good deal of ambiguity in the paper on the matter—that the light spirit in the gas made should be included in the total tar oils. There were some methods of low-temperature carbonization in which large quantities of light spirit were carried away in the gases—where producer gas, for example, was used. In order to give a proper view of the several methods of carbonization at different temperatures, where the gas volume made varied very much, the figures for tar oils should be the gross figures; and this was the plan he adopted. The best way of carrying out the test was not in a large lead bath, but in a steel retort, annular in pattern, in which the molten lead had inner as well as outer contact with the retort. In these matters the time and manner of carrying out the test were also very important, because different results were obtained according to the speed, &c. Again, when distilling tar, it was sometimes found, no matter how carefully the water was separated from the tar, that 10 or 15 p.ct. of water remained; and the figure obtained from such a distillation was different from that secured when the tar was dry. Therefore, he suggested that the best method of distilling was not only to do the water test separately, but to return the oils to the residual tar, and then distil and get the fractions on the dry tar, where there was no water present. There was a kind of steam distillation in the former case which upset the figures. He congratulated the technical Chiefs of the Fuel Research Department on having been successful in bringing out a vertical retort which would satisfactorily produce smokeless fuel in a uniform way and at a proper rate of speed.

Work for the Fuel Section.

Dr. H. G. Colman said that the test of his, to which reference had been made, was not suggested as suitable for a motor spirit. It was devised for aromatic hydrocarbons which were being used for explosive and dye-works purposes, in which absence of all saturated compounds was desirable. What was wanted was a test which would show the absence of all the gumming constituents, and would not show the presence of the olefines. He had tried many times to get such a test, but frankly confessed he did not know of one yet. With regard to Mr. Sinnatt's paper, he wished to enter a plea to those who were doing tests of these oils to come to some agreement as to what he might call the proximate analysis of low-temperature oils. At

present everyone was going on his own, and working by different methods; and it would be a very great advantage, and enable a proper comparison of results to be made, if some standard method could be agreed upon. They had now reached a stage at which it should be possible for the Fuel Section to take up this matter. In this he would include co-operation in other countries, for if they could get a more or less international agreement it would be a great advantage. This only referred to the first proximate analysis. To lay down standard detailed analyses would hinder, rather than help, because these were in the nature of research work. With regard to Mr. Adam's paper, he very heartily agreed that the lack of uniformity in the tests now employed for commercial testing of coal tar products was most unsatisfactory. If a sample was sent to him, as a referee, the first thing he had to know was what method was specified for testing. If no method was agreed upon, it meant that the seller and the buyer had different ones; and many of these methods which had grown up were giving entirely wrong results from the commercial point of view. He hoped that, when some agreement was reached, they would in the great majority of cases reject the old method in this country of putting the thermometer in the liquid ⅛ in. from the bottom of the retort, and that the thermometer would be placed in the vapour. In certain instances the placing of the thermometer in the liquid had led to more misunderstanding and more incorrect commercial results than had any other detail of these tests.

Dr. T. H. BUTLER remarked that the importance of the aqueous distillate in tars was likely to be overlooked. In some cases it contained chlorides, chiefly in the form of ammonium chloride. This, when distilled in the tar, dissociated at higher temperatures; and hydrochloric acid was formed. Corrosion of the still followed. As to the brittleness of pitch, he would like to give Mr. Sinnatt a word of warning. It was difficult to determine the brittleness of pitch, because tar distilled under different conditions gave entirely different grades. Therefore, to say that when coal was carbonized under certain conditions it would give a brittle pitch, and that under other conditions it would not, might be misleading.

STANDARD ENGLER FLASK.

Mr. C. CHAPMAN (Provan Chemical Works, Glasgow), after complimenting Mr. Adam on his plea for standardization, said he dealt entirely with vertical retort tar, and realized the shortcomings of the tests generally current at the present moment. The greatest drawback, in his opinion, was the continued use of the retort, which had come to be acknowledged as the emblem of the chemist, because no drawing of a chemist in his den was complete without a retort. From his experience with vertical retort tar, however, he had found the retort unnecessary. For the last six years he had not used a retort in any shape or form, except in a very few instances where material had been bought by the retort test. He adopted entirely the standard Engler flask, with a vertical form of Liebig condenser with water on the inside. This gave entirely concordant results, and was much handier to use than the old-fashioned retort. In his last paragraph, Mr. Adam said that all the existing methods would be of little value if entirely new ones were adopted; but he could not agree with this. He had advised comparatively new methods for use in his own department, in which the results obtained had to be correlated with those previously secured; and in every case a simple graph was obtainable for the comparison.

BRIEF REPLIES.

The CHAIRMAN indicated that the authors would reply fully in writing.

Mr. SINNATT, in the course of a few remarks, said that Dr. Davidson had criticized the Gray-King apparatus. He would reply that this test was simply a laboratory one. The work on oils described in the paper had been done on relatively large-scale tests of nothing less than 200 lbs.; and 600 lbs. and more had been used. Everybody could shake hands with Dr. Colman on this question of having tests standardized; and the appointment of a Committee in some form was probably the best way to deal with the matter.

Mr. ADAM said that reference had been made to the acid washing test, which was in universal use with various modifications. The subject was being investigated by the Research Committee of the National Benzole Association, who had a Joint Research Committee at Leeds University, he himself being Chairman. This matter had now been under investigation for two years, and had involved a large amount of work. The lines of the investigation were those mentioned —that the olefines in motor spirit were good motor fuels, and ought not to be removed. It was hoped in due course to publish the results of that work, which at the moment looked very promising. The problem of sulphur in benzole was dealt with fully in the National Benzole Association's reports, as also was the origin of the free sulphur. He agreed with the statement that the results obtained on a small-scale in the laboratory or even on a semi-technical laboratory scale, as regards pitch, could not be related to the results produced in practice. He agreed with Dr. Colman and Mr. Sinnatt that some Committee should be formed to deal with standardization, in order that testing throughout the country could be put upon a proper basis.

THE "FUSION" ROTARY RETORT.

Report of a Test by the Director of Fuel Research.

There has been published by H.M. Stationery Office (Adastral House, Kingsway, W.C. 2) a report* of a test by the Director of Fuel Research on a "Fusion" rotary retort installed at the works of Electro-Bleach and By-Products, Ltd., of Cledford, Cheshire. The plant is one of the class in which the material is turned over during carbonization; and this type of retort tends to produce large oil yields, but is apt to give only a comparatively small proportion of the solid residue in the form of lump coke. The actual unit tested was designed as an experimental plant, so that it could be used on a wide range of bituminous material. The nominal capacity of the plant—which was fitted neither with elevators and bunkers for the raw material nor with mechanical conveying arrangements for the solid residue, as would a commercial unit—was 5 tons a day.

DESCRIPTION OF PLANT.

Without entering into detail, we will give a brief description of the plant. The retort, which is heated by the sensible heat of the gases from a coke-fired furnace, is a mild-steel lap-welded tube, 25 ft. long and 2 ft. 6 in. in diameter, rotating in a horizontal position within a heated brickwork chamber. It contains metal breakers, usually five in number, each about 20 in. in diameter. These are not fixed in any way, and different types are used, depending on the nature of the material being carbonized.

A ring resting on eight steel rollers, four at each end, carried on spindles revolving in bearings, is fitted at each end of the retort tube, external to the heating chamber. The retort is driven from the charging end by spur gearing, the source of power being a 2-H.P. motor. An automatic feeder, driven direct from the retort, is mounted at one end. Adjustment of this feeder ensures a uniform flow of material to the retort.

A stationary chamber, into which all the products of carbonization pass, is fixed at the discharge end of the retort. The lower part of this chamber forms a residue hopper with automatic discharge valve, maintaining a constant seal of spent material. A considerable amount of the heavier tar condenses, and runs to a seal pot. The condensed tar is removed intermittently by hand to a storage tank adjacent to the plant. The joint between the chamber and the rotating retort is made by a thin sheet-iron disc, the outer edges of which are fixed to the chamber. A ring is mounted on the inner circle, and is pressed by coach springs against a metal-reinforced asbestos ring, mounted on the retort tube. The thin sheet-iron ring is made flexible by circular corrugations.

Gas and tar vapours leaving the chamber pass to a dust catcher, with a seal at the foot. The excess tar from this seal overflows to an adjacent tank, and from there is pumped to settling tanks. The gas and vapours next pass through a water-cooled tubular condenser, the light oil from which is separately collected. The gas then passes through a booster to a scrubbing plant, and subsequently through a meter to a 2500 c.ft. holder.

The coal used for the test, which was carried out in July, 1925, was Welbeck cannel containing a small percentage (less than 10) of bituminous coal. With this material a throughput of 3·4 tons per day was maintained during the test.

RESULTS OF INVESTIGATION.

The residue recovered was 58·8 p.ct. of the coal charged, and contained 9·7 p.ct. of volatile matter. It was too small for use either in the furnace or for the production of producer gas for heating the setting. With further pulverizing, it is stated, it would make a good pulverized fuel.

The total yield of tar and oils collected was 50·23 gals. per ton of coal carbonized, or 72·5 p.ct. of the assay yield (determined in the Gray-King assay apparatus). This yield could, by the introduction of better arrangements at the discharge end, be increased to 54·41 gals., or 78·2 p.ct. The total pitch in this mixed tar was low, amounting to 29·9 p.ct., or 131·6 lbs. per ton of coal.

The gas made was 31,800 c.ft. of 1070 B.Th.U. per c.ft. (gross), which is equivalent to 2740 c.ft., or 29·3 therms, per ton of coal carbonized.

The crude spirit (to 200° C.) obtained from the gas was 3·75 gals. per ton of coal. In addition, a further 2·69 gals. of spirit were obtained by washing the first fraction of the tar. The report states that it may be fairly assumed that, with proper refining, this spirit would be suitable for use as a motor fuel.

The temperatures maintained in the retort chamber were steady during the period of the test. The maximum temperature attained by the material carbonized was not in excess of 550° C. By increasing the temperature to 600° C., the gas yield would rise to about 3100 c.ft. per ton of coal; but no greater yield of tar would be obtained.

It is mentioned that the labour for running the plant was in excess of that which would normally be required. It is estimated that, working eight-hour shifts, three men, with an additional labourer on day-work only, would be ample for carrying out the necessary work each day, provided the mechanical devices referred to in the first paragraph of this article were installed.

* Price, 9d. net.

INTERNATIONAL CONFERENCE ON BITUMINOUS COAL.

By G. M. GILL.

The conference held in Pittsburgh from Nov. 15 to 18, with visits to works on the 19th, has been an undoubted success. The papers were generally of a high order, and dealt exhaustively for the most part with the subjects associated with coal and its utilization. All credit is due to Dr. Thomas S. Baker, the President of the Carnegie Institute of Technology, for his organization of the conference; and it should have far-reaching results.

The principal papers were delivered in the Carnegie Music Hall—a large theatre capable of seating 2000 people. The stage was provided with three movable microphones; and suspended above the body of the hall were a group of five loud speakers for the ground floor, and two further ones for the gallery. As a consequence, speakers were heard distinctly from all parts of the building. The excellent seats of the modern theatre in all parts greatly increased one's comfort, and had some share in keeping the percentage of attendance at a high figure. The idea of using a theatre for such a purpose impressed those present as being a very good one. No less than 1700 people attended the conference; and at times there must have been 1200 people in the hall. There was an atmosphere of enthusiasm and keen interest in the papers; and the audience comprised all grades of technical men and women, and others interested in the development of coal and its bye-products, gas, oil, and fuels generally.

Dr. Baker made himself very popular with all the representatives from foreign countries—and there were many present—and did not fail to keep them entertained in the evenings. At conferences of this kind the Information Desk, at which there are several well-informed persons to answer all kinds of questions and to assist those attending the meeting, is a well-established American system; and it certainly made things easy for the stranger on this occasion.

Many of the papers were read in other rooms of the College; and at times there were three papers being delivered at the same time in different rooms. The discussions were not very enlightening, and nearly the whole of the time was taken up in the presentation of the papers. It may be that the discussions suffered from the fact that the papers were not circulated beforehand.

Low-temperature carbonizing problems were fully treated; and it is curious that, like so many in England, the Americans are giving this matter a great deal of attention, though with a somewhat different object. Their purpose is to develop a class of fuel which will take the place of the high-priced anthracite that is now used in the American domestic furnace—a large edition of the coke boilers now installed in many houses at home. The American domestic furnace is usually situated in the basement, and is kept going night and day in the winter, supplying hot water for heating the house and for baths, washing, &c. The only disability of coke for this purpose is that, being light, it needs stoking to a greater extent than anthracite, and proportionately to its increased bulk per pound. For the same reason, it is apt to burn itself out during the night; and then trouble is caused in relighting it. The low-temperature carbonization problem is therefore to make a heavier fuel per pound than coke, and one with more free-burning qualities. It greatly surprised us to see the amount of attention which is being given to this subject.

It may be interesting to mention that the Carnegie Institute of Technology has over 5000 students, of which about 2400 are whole-timers. The amount of attention which is being given to technical education in America has greatly increased of recent years; and the munificence of such men as Andrew Carnegie is undoubtedly bearing rich fruit.

The five visits to works on Nov. 19 were full of interest. A large contingent went to the Claviton Bye-Products Coke Plant, of the Carnegie Steel Company, where 25,000 tons of coal are being carbonized per day, making a quantity of gas which would supply the whole of London and its suburbs. As to the social side, we were entertained to dinner by Dr. Baker on Nov. 15, and a large dinner was organized on Nov. 17. At both gatherings many interesting and amusing speeches were made. We were individually entertained in the truly hospitable American style; and all left at the end with the feeling that they had been kindly treated.

The whole of the proceedings of the conference are to be published in one volume, at a cost of $7.

NOTES ON SOME OF THE PAPERS READ.

BRITISH RESEARCH ON FUEL UTILIZATION.

By Dr. CECIL H. LANDER, Director of Fuel Research of the Department of Scientific and Industrial Research.

The paper commences with a general survey of the activities of the various bodies in England who are dealing with the question of the pre-treatment of coal. It then goes on to discuss, in much more detail, the work of the Fuel Research Board; the organization of the Department of Scientific and Industrial Research being described. Two lines of inquiry referred to in the first report of the Board were: (1) A physical and chemical survey and classification of the coal seams in the various districts; and (2) an investigation of the practical problems which must be solved if any large proportion of the raw fuel at present burned in its natural state is to be replaced by the various forms of fuel obtainable from coal by carbonization and gasification processes. The second line of inquiry involves a detailed study of carbonization in general, and of other processes suggested from time to time. Such problems cannot be finally solved by small-scale work in the laboratory. The development of any process from a laboratory to a works scale always presents difficulties; and in the class of work here in question the scale effect is pronounced and at present practically incalculable, owing to the complicated factors involved. For these reasons, a Fuel Research Station was erected (on the recommendation of the late Sir George Beilby, and to his designs), where trials could be carried out on units of full commercial size, but with the accuracy usually associated only with laboratory work.

HIGH-TEMPERATURE CARBONIZATION.

Shortly after appointment, the Board were asked to advise as to "the most suitable composition and quality of gas and the minimum pressure at which it should be supplied, having regard to the desirability of economy in coal, the adequate recovery of bye-products, and the purposes for which gas is now used." The recommendations made were in the main embodied in the Gas Regulation Act of 1920, and included the adoption of the "therm" basis for charging for gas. This enabled gas undertakings to adopt the method of gas manufacture most suitable to the local conditions in each case. To assist the industry in determining the most suitable method to adopt, many experiments have been carried out, using a number of typical gas coals, on the results of various ways of running vertical gas retorts. For the purposes of these tests, a setting of four commercial (high-temperature) gas retorts, of the continuously working vertical type, was installed.

The experience and data obtained from these vertical retorts proved so valuable that it was decided to erect a setting of horizontal retorts to gain similar data in connection with this type. Before doing so, a large number of gas engineers were consulted; and, although such retorts have been in use for many years, the opinion was practically unanimous that many useful investigations could be carried out.

LOW-TEMPERATURE CARBONIZATION.

The problem of carbonizing coal at low temperatures may be looked at from several aspects. For example, it may be that of finding a commercial outlet for some variety or grade of coal for which there is at present little demand. The Fuel Research Board, however, must consider the problem on the supposition that a successful solution from the national point of view will result in carbonization products being used for domestic purposes almost to the exclusion of raw bituminous coal. In a normal year, some 35 to 40 million tons of bituminous coal are used in this way in Great Britain, and this among the more highly priced varieties of coal actually mined. If this coal is to be carbonized, it means that a high-priced raw material is used; and as the coke can command little (if any) higher price than that of the raw coal, there is then no question of converting a low-priced coal into a higher-priced coke. If, on the other hand, it were possible to use large quantities of the lower-priced coal, the product would displace some of the high-priced coal on the market, and the relative pit-head prices of the different grades of coal would of necessity be altered. Incidentally, the gas produced by the carbonization of the domestic coal, together with the coal now carbonized in gas-works, would be more than is at present required as town gas, even allowing for the comparatively small yield of gas at low temperatures. It follows that the carbonization costs must be kept very low, if any profit is to be made from the process carried out on a really national scale. It does not follow, however, that the same necessarily applies to local developments in special circumstances.

On the technical side, the requirements vary according to local conditions, the type of coal available, the use to be made of the coke, and the markets for the tar and gas. It would appear definite that the maximum tar yields can only be obtained when the volatiles given off from the coal are rapidly removed from the retort. If the vapours pass through a bulk of coal or coke, or pass along both sides of the retort, con-

densation or decomposition takes place. Free passage of the vapours would seem essential; and a sweeping action by gas appears to aid the production and removal of the tar. On the other hand, if permanent gases are used for sweeping—especially if they also provide the heat for carbonization—the amount of gas to be dealt with by the condenser is increased, and larger condensers, working probably to a lower temperature, are necessary to recover the tar. If steam be used for this purpose, the cost of the steam may become serious.

Work on carbonization of coal at "low" temperatures has proceeded steadily at the Fuel Research Station since it was completed in 1919.

In order that accurate information should be made available on the results obtained by other workers on the problem of low-temperature carbonization, and their claims be thoroughly verified, the Department have undertaken to test full-size unit plants without charge for the services of the staff; the plants being worked by the owners under test conditions. No test is considered satisfactory unless the plant has worked steadily under test conditions for several days, and unless the material measured into the system agrees with the measured products leaving the system within about 1 p.ct. An "assay" apparatus was developed by Gray and King some years ago, and has been in constant use ever since, as the best available laboratory means of testing the coking qualities of a coal, and its probable yields when subjected to carbonization—especially low-temperature carbonization. The yields of tar are always greater in the "assay" apparatus than in a full-scale plant; and a comparison of the two yields, using the same coal, forms a convenient method of estimating the efficiency of a plant for the production of tar.

It is unfortunate that some promoters of low-temperature carbonization systems do not appear to realize this scale effect, and quote for yields figures obtained in the laboratory, as if they had been secured on a plant of commercial size. In some cases, the necessity for steady continuous running is also overlooked. It is only after a plant has been running steadily for months that a true estimate of its technical possibilities can be obtained; and proof of satisfactory commercial working can only be secured by steady continuous working for some years.

PRODUCTION OF OIL BY METHODS OTHER THAN CARBONIZATION.

There are other methods of obtaining liquid fuels from coal than that of low-temperature carbonization. The Bergius process consists in subjecting powdered coal, mixed into a paste with heavy oil, to pressures of over 100 atmospheres and temperatures of over 400° C., in the presence of hydrogen. Small-scale experiments at the Fuel Research Station have shown that by this means a much higher yield of oils is obtainable from suitable coals than by any known process of carbonization, even allowing for the coal expended on the power and heating requirements of the process. A strong British Syndicate has an option on the rights of the process for the British Empire, and is conducting experiments in conjunction with Dr. Bergius, to ascertain the possibilities of the process on a commercial scale. The technical difficulties of working at the temperatures and pressures involved are obviously great. In view of the importance to Great Britain of any process which will assist in increasing the oil supply, an agreement has been entered into with the British Syndicate, Dr. Bergius, and the interests now controlling the rights in the process. Under this agreement, the Department contribute towards the cost of an experimental programme laid down by a Joint Committee on which they are represented, and in return obtain full information as to all results and the right to have a representative present at any time. An intermediate-scale continuously working plant is also being installed at the Fuel Research Station for their own experimental use.

The paper concludes with an account of much miscellaneous work being carried out by the Board.

TRANSFORMATION OF COAL INTO OIL BY MEANS OF HYDROGENATION.

By Dr. FRIEDRICH BERGIUS.

The conversion of coal into oil is more particularly a European problem, owing to the scarcity of natural oil in Europe. In connection with the policy of conserving supplies of natural oil, however, it is also of interest to the United States. Of the three methods of obtaining oil from coal, one—namely, destructive distillation of the coal—is already well known; but the quantity of oil obtainable by this process is small in proportion to the amount of coke produced simultaneously, and the process is therefore only applicable within certain limits.

A second method starts out from products of gasification of the coal—particularly water gas, from which alcohols and hydrocarbons can be produced synthetically by passing the gas, at either ordinary or high pressure, over suitable catalysts. At present this process is only likely to be successful commercially if restricted to the manufacture of methanol and products of relatively high commercial value. The extremely careful purification which the gases must undergo prior to contact with the catalyst adds so greatly to the cost of the process that the method is scarcely worth consideration as a means of producing cheap liquid fuels.

The third method—the so-called Bergius process—is based on the fact that, when coal is heated to 400°-500°, the compounds of high molecular weight of which the coal is composed are split up into smaller groups, which are capable, without the intervention of a catalyst, of combining with hydrogen to form saturated compounds. In this manner, a complex mixture of liquid hydrocarbons is formed—similar essentially to mineral oil—also, in smaller quantities, gas on the one hand and pitch-like products on the other.

The fundamental reaction was observed as long ago as 1913; but the technical development of the process extended over nearly ten years. The main difficulties were encountered in attempting to render the process completely continuous. This requirement introduced many technical problems, in some cases of an entirely new character; but these problems can now be looked upon as solved. As an example, it was necessary to construct pumps which would be capable of forcing the coal continuously into reaction-vessels against a pressure of more than 200 atmospheres.

To-day the liquefaction of coal is a fully developed technical process, producing not only oils of various qualities, but also ammonia, in larger quantities than are obtained by the destructive distillation of coal. A special process has been developed for the manufacture of the necessary hydrogen, at a sufficiently cheap rate, from the gaseous hydrocarbons produced by the "Bergin" process. When possible, however, it is particularly advantageous to sell the "Bergin" gas, which has a very high calorific value, for domestic or industrial use, since the income from this source will at least cover the cost of manufacturing hydrogen from coke by one or other of the established processes.

One ton of bituminous coal will yield an average of 140 gallons of oil. Deducting the coal consumed in the process, the net yield is 104 gallons per ton of coal. Of this, 35 gallons consist of aromatic compounds, suitable for "no knock" motor fuel, and the remainder is gas oil, lubricating oil, and fuel oil. Except anthracite, nearly all grades of lignite and coal, especially screenings, can be liquefied. Some millions of dollars and twelve years of research work were necessary to make the liquefaction of coal an economical success; but large plants now exist in Germany.

It is obvious that the "Bergin" process can play a very important part in meeting the general industrial requirements of any country.

COAL AND ITS MINERAL MATTER.

By R. LESSING, Ph.D., &c.

If it were not for the dead weight of their ash content, there is no reason why solid fuels should not give even higher combustion efficiencies than liquid and gaseous fuels. Moreover, the ash-forming matter in coal, our principal solid fuel, affects its utilization in a number of ways other than in direct combustion; and it seems, therefore, important to devote more attention to the study of coal ash, valueless though it may be in itself, than it has received in the past.

To appreciate the significance of mineral matter in the utilization of coal, its incidence, composition, and distribution, the manner of its occurrence during coal formation, and the mechanism of coal formation itself must be closely examined. The keynote of the work done during recent years in the investigation of mineral matter is the characteristic association of certain inorganic compounds with each of the three or four principal groups of coal components. If the sub-division of banded bituminous coal into fusain, clarain, vitrain, and durain, proposed by Stopes and used by the majority of English coal research workers, is adopted, an examination of the ash of the four ingredients from one coal reveals considerable differences, in both amount and composition. The ash percentages obtained from the first coal examined—Thick Seam, Hamstead Colliery, South Staffordshire—were:

Fusain	15·59
Durain	6·26
Clarain	1·22
Vitrain	1·11

The four ashes showed remarkable differences in colour and physical structure; fusain ash being dark brownish grey, durain ash pale grey or white, clarain ash reddish-brown biscuit, and vitrain ash pale biscuit colour.

For practical purposes, clarain and vitrain may be grouped and considered together—particularly since in vitrain—which on the strength of transparent sections had originally been regarded devoid of morphological structure—cellular plant structure, though much obliterated, has been discovered by examining polished surfaces in reflected light.

The clarain-vitrain fraction (in which clarain usually preponderates) is that portion of coal having pronounced coking properties; while a large durain content is indicative of a non-coking or feebly-coking fuel. Whether this disparity in coking propensities is, at least in part, due to differences in the ash percentage and in the chemical character of the ashes, remains as yet an open question; but these factors influence the coking properties to a degree not generally realized.

Fusain, which is present in British coal to the extent of approximately 5 p.ct., contains widely varying percentages of ash of which the composition shows it is, in the main, the

residue of water which percolated the coal seam towards the final stages of coal formation, or after fusainization had made some plant remains sufficiently porous to absorb the salts dissolved in this water. Fusain ash contains a large proportion of carbonates in which either lime or iron may predominate.

The mineral matter contained in the four compounds forming the actual coal accounts for a comparatively small portion of ash found in commercial coal as mined or marketed, amounting to about 3 p.ct. or less.

Coal Sampling.

The lack of homogeneity in the distribution of ash over a quantity of coal causes considerable difficulties in drawing samples from a cargo or consignment. The estimation of ash is probably the most important operation in the examination of coal for commercial purposes. As the ash percentage varies with the size of lump or particle, and as there is segregation according to size taking place on loading coal or heaping it up, the ideal method of drawing samples would be to grade the bulk by screening, draw samples from each grade, and combine aliquot portions of each grade according to their contribution to the bulk. This method would be economically impossible with large consignments, but is worthy of consideration when dealing with the first bulk sample taken, for its further sampling and preparation for analysis.

Satisfactory sampling of coal presents a problem of its own; and in view of the values of coal and the world-wide commercial interests involved, it seems highly desirable that appropriate methods applicable to the various conditions met with should be adopted by international agreement.

Scientific Control of Coal Washing and Cleaning Processes.

Most of the existing washing and cleaning processes and plants labour under the difficulty that they have not been conceived with a full appreciation of the true composition and distribution of mineral matter in coal, and that the existing knowledge of physical and colloidal chemistry concerning the phenomena involved is not yet applied to a sufficient extent. The full significance of the colloidal aspect of washery waters is not being grasped by the majority of designers and operators; and intensive research in this direction would lead to greatly enhanced efficiency.

During the last few years, however, greater attention has been given to these points, particularly in the direction of establishing washability curves on the basis of float-and-sink tests, and of radiographic examination.

Influence of Ash.

In the liquefaction of coal by hydrogenation, according to Bergius, an undue ash percentage in the coals treated adds enormously to the difficulties of design and maintenance of the high-pressure plant, particularly by the erosion of the inlet and outlet valves of the autoclaves.

In direct combustion processes, which absorb by far the greatest bulk of all coal produced, the chemical composition of the ash-forming ingredients may often determine the behaviour of the fuel on the grate, and its heating efficiency; for on it depends in its turn the fusibility or refractoriness of the ash. Fluxes—*i.e.*, iron, alkaline earths, or alkalis—lower the melting-point of the ash and produce clinkering, and hence clogging of fire bars or producer beds, inclusion of unburnt carbon, and difficulties of air admission to the fuel bed. A low percentage of fluxes avoids these troubles, and gives a " clean " fire, and thorough aeration of the fuel bed.

The " melting " point of coal ash has been investigated very closely, particularly by Fieldner and his collaborators, who have given special attention to the influence of an oxidizing or reducing atmosphere upon the fusibility test, inasmuch as it affects the melting-points of the oxides or silicates of iron.

In view of the difference of ash composition in the four coal components and the extraneous minerals, a note of warning should be sounded—that the results of melting-point tests must be applied judiciously. For, as a result of the irregular distribution of ash-forming bodies over the mass of coal components and the extraneous minerals, conditions in practice are very different from those in tests on finely ground and homogeneously mixed average samples. While, thus, a slag film of clarain ash or ankerite parting may not lower the fire stability of a lump of durain ash burned to a highly refractory firebrick, the fluxes in an ash of the same mean composition, ground and intimately mixed, would have a much more marked effect on the less fusible portions.

Again, size of particle is of considerable importance; and as it increases, clinkering is promoted. The ash from powdered fuel approaches most nearly the condition of the melting-point test, at least at the point where it is collected, though while freely suspended in combustion gases each particle follows the melting-point laws fairly strictly.

Mineral Matter in the Carbonizing Process.

Our knowledge of the behaviour of the inorganic compounds in coal during the coking process is very restricted. The reactions under its reducing conditions are bound to differ from those it undergoes in oxidizing combustion. Moreover, some of the compounds formed may react again when the hot coke produced is cooled to ordinary temperature.

Inorganic Compounds as Catalysts.

The influence of mineral matter on carbonization and combustion, which I consider the chemically most important, scientifically most interesting, and practically most promising function, is its capacity of directing catalytically the course of thermal decomposition of coal and other organic matter. For many years I have pressed for recognition of the part of catalysts which some inorganic substances play in the reactions involved, until recently with most disappointing response from practical gas and coke-oven men.

There is little room for doubt that some inorganic compounds influence the carbonizing mechanism. The remarkable quantitative variation in the yield of coke, according to the catalyst employed, is equalled, if not surpassed, by the extraordinary differences in physical characteristics of the coke specimens obtained. Further, as is shown by the results obtained with coal, the ratio of solid residue to volatile products can be influenced at will, as can be the properties of both.

Last year some of this work was repeated by Marson and Cobb, to whom I had pointed out the necessity of considering the composition of the ash in all carbonizing experiments; and their results confirmed this view.

They have recently further examined the influence of some catalysts on the physical properties of the coke, and particularly on its reactivity, to which I had called attention, by gasifying it in steam, and ascertaining the water gas equilibrium under definite experimental conditions. This work fully confirms the conclusions drawn from the previous investigations.

The catalytic activity of certain ash constituents or additions is not restricted to the carbonizing process at high or low temperature, but also applies to combustion, whether carried to completion, as in industrial and domestic heating practice, or in the form of partial combustion, as in gas producers.

The importance of catalysts is not likely to be of less account in the hydrogenation of coal, which will now probably emerge from the experimental stage to become a practical, commercial process.

We are on the threshold of a new era in the utilization of coal; and the possibility foreshadowed of refining the natural product, of concentrating its intrinsic value, and of applying it in novel ways, is rapidly changing our conception of its potentialities, and is making us realize that we are witnessing the beginning of a revolution in the application of our principal source of energy.

INDUSTRIAL TRANSFORMATION OF BITUMINOUS COAL INTO ORGANIC TECHNICAL PRODUCTS.

By General Georges Patart.

Considering bituminous coal as a complex colloidal substance, the various processes for transforming this raw material into useful products are discussed. These include the extraction by solvents, regulated oxidation, hydrogenation, and, finally, distillation at both high and low temperatures. The utilization of the permanent gases produced by distillation, as well as the gases made from the coke, in the manufacture of ammonia and oxygenated organic compounds, is described. These new industrial organic products are then discussed.

Alcohol Synthesis and the Gas Industry.

From the practical and industrial points of view, to the exclusion of other special considerations, the industry of the synthesis of alcohols would be placed in the most favourable position by associating it with the operation of a plant engaged in the production of coal gas for supplying a large city located in a coal mining district rich in bituminous coal. For example, if this plant were operating under the conditions that have been described for the Joliet plant of the Coal Products Manufacturing Company—that is, by a series of eight operations of gasification, after which takes place the charging of 2200 lbs. of coal; each operation comprising two minutes for the air blast (blow run), 2·75 minutes for the injection of steam (50 p.ct. from below and 50 p.ct. from the top), and 0·25 minute of purging—the gas intended for the catalytic synthesis would be withdrawn only during the last three operations, and only during the period of the steam injection into the top of the gas generator, which would represent 12 to 15 p.ct. of the total production. There would thus likely be obtained a gas containing but very little methane and nitrogen, and one particularly suited for synthesis. As for the purging gases of the synthesis apparatus, they would be returned to the gas generator during the early part of the steam blast, and would restore to the gas make their high calorific power.

Thus one would arrive at a very economical production that would correspond, according to calculations, to a net consumption of gas of 2·5 cub.m. per kg. of pure methyl alcohol and 4·2 cub.m. per kg. of isobutyl alcohol, which represents a net consumption of raw coal that does not exceed 2 kg. per kg. of methyl alcohol and 3 kg. per kg. of isobutyl alcohol. At the same time the cost of the original plant would be consider-

ably reduced. The synthesis of alcohols appears, then, from this point of view, to be an adjunct to the manufacture of gas.

INSTANTANEOUS CARBONIZATION OF CRUSHED COAL.

By ALFRED H. WHITE, University of Michigan.

If coal crushed to pass a 20-mesh sieve is allowed to drop freely through a vertical retort heated to a rather low red heat, it carbonizes to a very considerable degree in the fraction of a second required for it to fall 6 ft. or even a shorter distance. The coke thus produced is composed of individual particles with a porous, bubble-like structure. The amount of volatile matter may be controlled by the size of the coal and the length and temperature of the retort. It pulverizes readily, and seems well adapted for use as powdered fuel. With some high-volatile coals, the removal of a portion of the volatile matter yields a semi-coke which gives a superior hard coke on destructive distillation in mass by the usual methods. The gas evolved as the coal falls through the retort does not have to filter through hot coke, and so is of uniform quality.

ENGLISH DEVELOPMENTS IN CARBONIZATION OF COAL IN GAS-WORKS.

By GEOFFREY M. GILL.

Notice of this paper (the reading of which was illustrated by seventy lantern slides) is held over, in view of the possibility of its publication by the author in book form.

ECONOMIC ASPECTS OF THE CONVERSION OF COAL INTO SMOKELESS FUEL.

By Dr. HORACE C. PORTER, of Philadelphia.

Gas, semi-coke, and coke are smokeless fuels made from bituminous coal at a certain cost of conversion—not only a cost of operating and for plant investment, but one arising also from loss of total available heat in the products. It is necessary, therefore, to compensate these losses by an enhanced unit value in the products and bye-products, and establish a margin for profit and contingent expense. Unless investors can see a clear margin on paper of 15 p.ct. to 20 p.ct. on the invested capital to cover promotion and the risks of market uncertainty, interruption of operations, price fluctuations, &c., they are unwilling to go far in laying out capital. The incentive presented by the products of low-temperature carbonization of coal has not yet reached such a margin. It may come when the public demands the virtues of these products, or when costs of conversion are brought lower.

The use of gas as a domestic heating agent will grow rapidly as its price is reduced through suitable changes in rate structure and quality standards, and the working of large central producing stations.

THE SYNTHESIS OF PETROLEUM.

By Dr. FRANZ FISCHER, of Mulheim-Ruhr.

Concerning the hydrogenation of carbon monoxide, Dr. Fischer says: I and my collaborator, Dr. Tropsch, studied thoroughly the hydrogenation of carbon monoxide under high pressure. To avoid the easily occurring deposition of carbon by the so-called splitting of the carbon monoxide ($2\,CO = C + CO_2$), we worked with a surplus of hydrogen. Alkalized iron proved to be the best contact substance. We obtained an oil consisting almost exclusively of higher alcohols, ketones, and aldehydes, besides some higher fatty acids. For brevity's sake, we gave the name of "Synthol" to this mixture. With a surplus of hydrogen, no hydrocarbons, but exclusively products containing oxygen, appear.

SYNTHESIS OF PETROLEUM HYDROCARBONS BY HYDROGENATION OF CARBON MONOXIDE AT ORDINARY PRESSURE.

My collaborator, Dr. Tropsch, and I have been working together for years in the domain of carbon monoxide in the most varied directions, and have finally found the way to produce from carbon monoxide and hydrogen, without use of pressure, the liquid and solid saturated hydrocarbons of the petroleum series. In this process there appear no compounds containing oxygen, while in the case of the pressure synthesis of carbon monoxide with a surplus of hydrogen, only products containing oxygen are made. The worries that many people cause themselves with reference to the technical practicability of our synthesis do not oppress us. We solved the problem of the purification of technical gases in a simple manner; and the durability and possibility of regeneration of the contacts leaves nothing more to be wished. The fear has also been expressed that the apparatus would become too large if the work proceeded at atmospheric pressure. But from another side it has already been correctly pointed out that no one would think of performing the cheaply working contact process for the production of sulphuric acid under higher pressure in order to get smaller tube diameters and smaller apparatus.

We have conducted experiments to see whether there might be any difference in regard to the results and in regard to the durability of the contacts, when we used alternately synthetic gas and technical water gas purified according to our method. The synthetic gas was obtained by mixing electrolytic hydrogen with carbon monoxide; the latter being generated by dropping formic acid into heated concentrated phosphoric acid, and washing. The result of these comparative experiments was excellent, since both kinds of gas acted exactly in the same manner, not only temporarily, but permanently.

On the other hand, we determined that if the hydrogen sulphide is removed from technical water gas, the efficiency of the contacts is very much worse, but not completely zero.

As catalysts we use, in contrast to Sabatier's synthesis of methane, generally not nickel, but cobalt or iron; and I should like to mention that we learned in the course of time to carry out the process also without activating admixtures of any kind—for example, with finely-divided iron alone, or with finely-divided cobalt alone.

An essential characteristic of our method is the use of temperatures that are too low for the formation of methane. We balanced the inertness of reaction produced thereby by the most careful preparation of the catalysts; and it may be interesting to know that, while formerly we had to regenerate the contacts from time to time, to-day we know the conditions under which they become better and better by themselves.

As to the absolute yield, more than 100 grammes of solid, liquid, and easily liquefiable hydrocarbons to each cub.m. of water gas can be obtained if the gas is conducted several times over the contact. Though we may assume that in the course of time the conditions may be worked out still better, it is, perhaps, most practical at the beginning to make the process an intermediate one in water gas plants, to take out the benzene, and to continue to use the gas left, as formerly. Of course, for economic reasons, the most valuable coke will not be used for this purpose, but the grades of coal and coke that are the cheapest, and out of which the water gas can be produced at the lowest prices.

"L. & N." (SENSIBLE HEAT) DISTILLATION.

By HARALD NIELSEN.

In this contribution, Mr. Harald Nielsen, having dealt in a general manner with the need for paying attention to the most efficient methods of utilizing our fuel resources, and having outlined the advantages of the "L & N" process [see "JOURNAL" for Dec. 9, 1925; Feb. 10, 1926; June 23 and 30, 1926], and given working costs, goes on to consider the method of obtaining the best products.

Owing, he says, to the inherent nature of coal, retorting generally has been asked to do too much. Broadly speaking, the retort was requested to produce the hardest and densest solid residue, the biggest quantity of liquid—*i.e.*, oily products which would leave Pennsylvania well-oil far behind—and the largest volume of the highest calorific value gas. To this day a vast number of investigators are still working towards this retorting Utopia.

The best working conditions for one set of products are detrimental to another set. In trying to do too much, enthusiastic investigators usually spoil everything.

SOLID RESIDUE.

The solid residue may be required for industrial or domestic use. For industrial or power purposes, cheapness and suitability come first. It is therefore essential to extract everything of higher value, to bring down the costs. With few exceptions, the size of material does not play any important part. What is of importance, is free and easy burning.

We have found that, by carrying out the distillation so that no graphitic carbon is deposited on the cell walls of the solid residue, the actual percentage of volatile matter left has little to do with ignitability. It has been maintained that, for successful burning of coke in the powdered state, 10 to 12 p.ct. of volatile matter is desirable. This is not so. Large-scale tests on burning our solid residue have proved the correctness of our contention (see the "Iron and Coal Trades Review," June 18, 1926).

We have found that the power requirement for grinding the "L & N" solid residue is from 10 to 15 p.ct. less than that needed for the original raw coal. It is possible to produce a standard powdered fuel from our residues from varying classes of coal with the same physical properties, moisture adsorption, combustibility, specific gravity (real sp. gr. 1·42 to 1·45), and volumetric gravity (about 48 c.ft. per ton). The space occupied by the powdered "L & N" residue is thus the same as that of raw powdered coal.

A domestic fuel must be smokeless, clean to handle, and uniform in size (no smalls), have a low ash content, be transportable, free burning and easily ignitable, uniform in calorific value and quality, as dry as possible, and weather-proof.

These demands can only be met by a manufactured article, Only carefully washed or good grades of bituminous coals should be used in order to secure low ash percentage in the solid residue. When distilling coals in a rotary retort, particularly those of the feebly or non-caking kind, by far the largest percentage of ash in the solid residue is found in the fines—a classification takes place inside the retort. The fines may be screened from the large sizes, and used industrially;

and the larger fuel, above (say) ½-in. mesh, contains little more ash than does average raw coal.

If a strongly coking coal is available, the possibility exists of briquetting during an intermediate stage, when, or just before, the coal reaches the plastic condition. This operation must be carried out in a neutral or slightly reducing atmosphere, and without too much loss of heat. The briquettes must be re-admitted to the retort, to be further distilled to remove the largest possible percentage of volatile matter. A blend of non-coking and strongly-coking coals can be dealt with in the same manner, thus utilizing the excess coking properties of the one coal.

We have made excellent briquettes using our residue with various vegetable binders, such as Kasawa; but the weather-proofing does leave something to be desired, particularly for the English climate. We have, however, found that, in making ovoid briquettes, and using a pitch binder, 10 to 15 p.ct. less binder is required for the distilled residue than for the raw coal.

OILS.

Many workers lay particular stress upon the fact that the oils obtained by distillation from coals should be primary products. We entirely agree. All our endeavours have been in the direction of obtaining these. We think that we are now justified in asserting that all neutral primary oils produced from bituminous coals, and even from brown coals and lignites, are identical. This is a sweeping statement, but it can be supported.

The following table indicates what may be obtained from the average oil produced from 1 ton of bituminous coking coal by distillation by means of the sensible heat of gas in a rotary internally heated "L & N" retort, excluding the light spirit from scrubbing the gas.

100 P.Ct.	By Distillation and Refining.	Lbs.	Gallons.	Total Gallons.
3·8	Light burning oil	8	= 0·925	..
9·5	Diesel oil (neutral)	20	= 2·190	..
	Total neutral burning oil			3·115
9·1	Light lubricating oil	19·1	= 1·890	..
10·3	Heavy lubricating oil	21·6	= 2·020	..
	Total refined lubricating oil			3 91
1·4	Paraffin wax, purified	3	..	0 33
15·5	Higher phenols and cresols, boiling 200° to 300° C. Highly disinfectant R.W. = 15	32·5	= 3·13	..
21·5	Phenols above 300° C., R.W. = 3	45·2	4·35	
	Total acid oils			7·48
13·1	Pitch coke	27·5	..	..
5·2	Distillation losses	..	..	..
10·6	Refining losses by using 10 p.ct. sulphuric acid, concentrated	..	..	..
100	Saleable refined oils recovered	..	..	14·835

The total quantity of saleable oil will be found to vary between 74 and 78 p.ct. of the total anhydrous crude oil—which, we claim, is more than can be produced by any other distillation or carbonizing process known to us. As for the heavy lubricating fraction boiling above 360° C., we have not been able to locate this in any other coal oil except our own.

Carefully-conducted tests by independent authorities of the highest standing have conclusively proved that the lubricating oils obtained from coal by the correct method are certainly as good as those obtained from well oils.

GAS.

When employing externally heated retorts for low-temperature treatment of coal, a large volume of gas has always been regarded as a sure sign that the oils have been decomposed. Under the above conditions, the assumptions are correct. A widely different aspect is provided by correctly-applied internal counterflow heating. The temperature to which the coal, or rather the solid residue, is subjected after the oils have been set free cannot possibly interfere with the latter. All that happens is that the volatile matters left in the residue after the oils have been expelled are given off as permanent gases. The gas volume obtained in this second stage is generally double that obtained in the first stage. The volumes and relative percentages of components of the mixed gases are shown in the following table:

Coal I. is a Scottish non-coking coal.
" II. is a semi-coking coal from the Doncaster district.
" III. is a coking coal from the Barnsley district.

Gas Analysis.	Coal I.	Coal II.	Coal III.
	P.Ct.	P.Ct.	P.Ct.
$CO_2 + H_2S$	0 53	5·78	4·87
C_mH_n	0·82	0·14	0·81
O_2	0·30	0·97	0·62
CO	14·46	10·10	12·46
H_2	39·76	49·30	46·10
CH_4	30·35	29·25	28·70
C_2H_6	1·70	0·57	1·71
N_2 + loss	4·07	3·89	4·73
Calorific value, B.Th.U. per c.ft.	515	495	507
Total volume of mixed gas, dry coal	8350 c.ft.	7900 c.ft.	8450 c.ft.
Spec. gravity, air = 1	0·535	0·440	0·465
Weight per cub. m., 0°, 760 mm.	0·6931 kg.	0·5683 kg.	0·6024 kg.
Weight per c.ft.	0·0406 lb.	0·0362 lb.	0·03825 lb.
P.ct. inerts in gas	12·9	10·64	10·22
Therms per ton of dry coal	43	39	43
Oil obtained, gallons per ton	21	21	17·5

We have proved, by numerous tests, that the combustibility and reactivity of the solid residue are not in any way impaired by the removal of the volatile matter.

GAS PRODUCER PRACTICE.

In an ordinary producer, only 70 p.ct. of the total heat is recovered in the gas as latent heat; the balance, or 30 p.ct., being accounted for as sensible heat in the gas, radiation losses, convection losses, unburnt carbon, soot, &c.

We take 25 to 30 p.ct. of the coal to be gasified, powder it, and fire it with the necessary air, *plus* a slight surplus to assure complete combustion in a furnace built like a rotary cement kiln. The other 70 p.ct. enters the kiln at the opposite end. The combustion of the 30 p.ct. of coal provides the requisite reaction temperature and CO_2 volume. We now have the interaction between CO_2 and carbon at very high temperatures, with consequent reduction of CO_2 to CO. Steam may also be admitted, to obtain the steam-carbon reaction. Since the operations are conducted in strict counterflow, the carbon will continuously meet higher and higher temperatures, until completely consumed. The ash is removed as clinker at the lower end of the kiln. We have now erected plant and commenced large-scale experiments along these new gas-producing lines. As far as we can see at present, practical possibilities exist of dealing, in a single gas producer, with from 150 to 200 tons of fuel per day.

TESTING SPENT OXIDE.

[D. Stavorinus, of Amsterdam, in "Das Gas- und Wasserfach," Sept. 11, 1926.]

Brief reference is made to various methods which have been used or suggested for determining the quantity of free sulphur in spent purifying materials. A variation of the usual method of extraction by means of boiling carbon bisulphide was communicated some time ago by Styns, of Rotterdam, in "Het Gas," in which he advocated the use of active carbon. This was obtained under the name "Norit" medicinal carbon, very finely powdered, and was mixed with twice its own weight of spent material, which had been dried, finely powdered, and weighed. This mixture was treated in the usual way with carbon bisulphide, and, after the final distillation, the pure yellow sulphur only remained, without tar or oil impurities. Subsequent experiments showed that previous mixing was unnecessary; the same result being obtained by merely introducing the oxide into the distillation flask which already contained the carbon.

Experiments have been made for some years at the Amsterdam Gas-Works with the object of eliminating, if possible, the unpleasant necessity of dealing with boiling carbon bisulphide; and for some time now the process of extracting the sulphur has been effected without any heating, with equal success, and just as quickly as usual. A glass tube of 25 mm. diameter is drawn out to a point about 5 cm. long, which ends with an aperture of about 2 mm. The cylindrical part is 15 cm. long, so that the total length is 20 cm., and the capacity about 60 c.c. A weighed sample of about 100 grammes of spent material is dried at 80° C., and the loss of weight noted as moisture content. The dried sample is then finely ground, and passed through a mesh 900 to the square cm. A small wad of cotton wool is pressed lightly and evenly into the tube, 5 grammes of the carbon powder are introduced, and the tube is tapped gently so that the carbon rests evenly on the wool. Then 10 grammes of the sample are introduced, and allowed to lie evenly on the carbon. The tube is then fixed in a clamp, and a weighed glass crystallizing dish, of about 100 c.c., placed beneath it. Carbon bisulphide is now poured in until the tube is full. This first filters through the sample, dissolving out the sulphur, and then through the carbon, which retains the tar and oil. After about a quarter-of-an-hour, it begins to drip out of the tube into the dish; the wad of wool being sufficient to retain the carbon. When all the carbon bisulphide has passed through, the process is repeated twice more with fresh solution. Altogether about 150 c.c. are required, sometimes less, yet this

is quite sufficient for complete extraction of the sulphur. A test, sufficiently far advanced, can be left to complete itself overnight, and, if in a good draught cupboard, the carbon bisulphide will have evaporated by the morning, leaving nothing but crystalline sulphur. Only a short space in the drying cupboard will then be necessary until the weight remains constant. If it is desired to obtain an idea as to what quantity of tar and oil substances there is in the material, another test can be made omitting the carbon.

Repeated check tests have shown this method to be entirely reliable with the stated quantity of CS_2. The passing of further quantities through the material has in every case produced only unweighable residues after evaporation. In this process, there is, of course, no recovery of the carbon bisulphide, but its use is so sparing, and the spent oxide test so comparatively seldom required, that this is not considered of much importance. The method is in common use in Holland, and is definitely prescribed in arbitration cases.

AN EXPERIMENT IN GAS COOLING.

[Lenze and Rettenmaier, of Hamborn, in "Das Gas- und Wasserfach," Aug. 14, 1926.]

The authors described their investigations into the possibilities of cooling gas from the settings to a lower temperature than is customary, with a view to eliminating as many as possible of the ordinary processes of ridding the gas of tar, naphthalene, ammonia, and water vapour.

In theory, the temperature to which the gas must be cooled, with this object in view, is determined by the vapour pressure of the naphthalene, water vapour, and ammonia. At 0° C., the vapour pressure of the naphthalene is 0·006 mm. Hg, representing 4·5 grammes per 100 cub.m. of gas [1·97 grains per 100 c.ft.]. This is equivalent to the working of a very efficient naphthalene washer. Even at 0° C., the water vapour has a tension of 4·54 mm. Hg, representing 474 grammes per 100 cub.m. [207 grains per 100 c.ft.], which is still far too high. As regards ammonia, the position was far less clear. A temperature of −33·5° C., which would be necessary for complete condensation to liquid ammonia, is, of course, out of the question. But an important point was to ascertain in what form the ammonia would separate out at the lower temperatures—whether as aqueous solution of ammonia, or in chemical combination with acid constituents of the gas, with carbon dioxide, or sulphuretted hydrogen.

Apparatus Employed.

The test apparatus used consisted in a rectangular gas-tight chamber, divided into three compartments, each containing cooling tubes; the cooling medium used being liquid ammonia. The test gas passed zigzag through the three chambers, and the condensates from each were collected separately. It finally passed through a scrubber with adjustable water supply. The gas used was a coke-oven gas, which, before entering the apparatus, had passed through an air and a Reutter condenser, as well as an exhauster and a tar separator. It was introduced at temperatures from 10° to 30° C. According to the initial temperature, the naphthalene varied between 30 and 60 grammes per 100 cub.m. [13 and 26 grains per 100 c.ft.], and ammonia between 170 and 400 grammes [75 and 175 grains per 100 c.ft.]. The gas was cooled to a temperature of 0° to −2° C. at the outlet, and was passed at a rate of about 300 cub.m. [10,600 c.ft.] per hour.

Results.

The tests were carried out over a period of six months, and the following is a summary of the results and deductions. The naphthalene in the gas, which amounted initially to between 30 and 60 grammes per cub.m., was reduced by the cooling to 4 to 6 grammes. It separated out partly in flaky crystalline form, which came out with the fluid concentrate. But for the most part it took the form of a dark oil, which was easily separated from the rest of the concentrate. This oil consisted as to 80 p.ct. of a naphthalene fraction with very high naphthalene content, with 20 p.ct. of light oil. The latter contained the higher benzole homologues, with boiling points between 130° and 180° C. Benzole and calorific value determinations before and after the cooling showed only negligible differences. The ammonia contents, from 170 to 400 grammes before refrigeration, were reduced to between 80 and 150 grammes. The condensate from the chambers contained 70 to 105 grammes per litre [4914 to 7371 grains per gallon], and so was equivalent to a concentrated ammoniacal liquor. The remaining 80 to 150 grammes of ammonia were removed in the scrubber with the least possible quantity of cold water, and there was no difficulty, at 0° C., in reducing the ammonia in the gas to between 2 and 3 grammes per 100 cub.m. [0·9 to 1·3 grains per 100 c.ft.]; the resultant washing water from the scrubber containing 2 p.ct. of NH_3. The quantity of condensate obtained, including oil and liquor, corresponded with the amount theoretically anticipated for the degree of refrigeration used.

To find in what form the ammonia was present in the condensate, the NH_3, CO_2, H_2S, and HCN were determined separately, with the following results:

Total ammonia	96·3 gms. litre	= 6760 gr. gallon		
Volatile ,,	96·0 ,, ,,	= 6739 ,, ,,	= 5·6 mol.	NH_3
CO_2	129·0 ,, ,,	= 9056 ,, ,,	= 2·93 ,,	CO_2
S	4·9 ,, ,,	= 344 ,, ,,	= 0·15 ,,	H_2S
HCN	0·3 ,, ,,	= 21 ,, ,,	= 0·01 ,,	HCN

Analysis showed that the ammonia was entirely in a state of combination with acids, particularly with CO_2. Ammonium sulphide was present in extremely small quantities, owing to the less acid nature of sulphuretted hydrogen. According to the formula $(NH_4)_2CO_3$, ammonia and carbon dioxide should be present in the proportion

$$2NH_3 : (2NH_3 + CO_2) :: 34 : 78 :: 43·6 : 100,$$

which gives 43·6 p.ct. NH_3 and 56·4 p.ct. CO_2. Against this, the values found in the actual condensate give

$$96 : (96 + 129) :: 42·7 : 100,$$

or 42·7 p.ct. NH_3 and 57·3 p.ct. CO_2, so that it may be regarded as practically 20 to 30 p.ct. ammonium carbonate.

Temperatures for Ammonia Separation.

In order to discover the working temperature most favourable to the separation of ammonia, the curves for the partial pressure of the NH_3 in the condensate at various concentrations in the temperature zone from + 5° to −10° C. were ascertained, according to the method of Terres and Weiser. The 9·6 p.ct. condensate was diluted with water, and 1, 4, 7, and 9·6 p.ct. solutions were tested. The following results were obtained:

Concentration of the Solution NH_3 p.ct. representing $(NH_4)_2CO_3$.	Partial Pressure. Mm. Hg. Col. representing	Grains NH_3 per 100 C.Ft.
At + 5° C.		
1	2·82	0·59	25·8
4	11·28	1·54	66·8
7	19·74	2·51	109·2
9·6	27·07	3·45	150·6
At ± 0° C.		
1	2·82	0·38	16·5
4	11·28	1·02	44·9
7	19·74	1·58	70 8
9·6	27·07	2·21	96·7
At − 2° C.		
1	2·82	0·33	14·7
4	11·28	0·83	35·9
7	19·74	1·33	58·0
9·6	27·07	1·82	79·3
At − 5° C.		
1	2·82	Solution Froze	Solution Froze
4	11·28	0·65	28·8
7	19·74	0·99	42·9
9·6	27·07	1·41	61·2
At − 8° C.		
1	Solution Froze	..	..
4	,, ,,	..	..
7	19·74	0·80	35·1
At − 10° C.		
1, 4, 7	Solutions Froze	..	..
9·6	27·07	0·90	39

For comparison, pure ammonium carbonate solutions were made by saturating distilled water with CO_2 and NH_3 in correct proportions, and the partial pressures determined in the same way at 0° C. The results showed only very small differences compared with those obtained from the condensate.

The curves obtained as above indicate that, for practical purposes, the use of temperatures very little below 0° C. will not effect a complete separation of the ammonia. In fact, the curves flatten out so sharply at 0° C., and the quantity of ammonia remaining in the gas diminishes so slowly after that point, that any further cooling would seem inadvisable. It would appear better in the earlier stages of the cooling—that is, in the first two chambers—to win concentrated liquor with 7 to 9 p.ct. of ammonia, and at the end to reduce the concentration to about 2 p.ct. of ammonia by adding diluted liquor or pure water. In this way, according to the curves obtained, the gas will leave the cooling chambers with about 60 grammes of ammonia per 100 cub.m. [26·5 grains per 100 c.ft.], which is subsequently washed out in the scrubber, whence also a 2 p.ct. liquor is obtained.

Summarizing their findings, the authors maintain that, by cooling the gas down to 0° C., naphthalene washers are entirely displaced, and that ammonia washing can be limited to only one water scrubber. The liquor obtained has a higher ammonia content than usual. Since the above experiments, a larger plant has been put into operation; and further results, with estimates of the payability of the system, are promised.

THE TANKLESS GASHOLDER.

As readers are aware from various references which have been made in the "JOURNAL," several examples of the waterless gasholder have been, and are being, constructed in the United States, some of them of considerable capacity. Interest in these and their design has been enlarged since the publication in our columns of information relating to the disaster to the Posen holder, and the discussion of the relative merits in respect of safety of the tankless and the older types of holder. In all considerations, from the engineering standpoint, of the different types, their relative safety must ever be given prominence, inasmuch as, in the system of gas supply, the holder is the part upon which reliance is placed for continuity of service, and the part which is of such economic importance to gas in relation to meeting variable demand through the day, and at different seasons of the year.

As Posen illustrated, the most critical component in the structure of waterless holders is the space above the disc and below the roof of the container, which space forms harbourage for any gas escaping round the periphery of the disc. We have, since our criticisms which emphasize these dangers, heard that improvements have been made so as positively to prevent any such escape. So far as we have seen, there has been no publication of the nature of the improvements which are said to give assurance that gas will not escape in future erections into the chamber formed above by the descent of the disc as the contents of the holder are drawn upon.

As remarked above, American gas engineers have been extremely interested in the discussion of this subject. Among others, the Stacey Bros. Gas Construction Company, of Cincinnati (through Mr. Paul C. Rodgers), have been investigating it; and several considerations have led them to the conclusion that the old types of construction are still preferable from technical and other points of view. Prompted by the discussion which took place in the columns of the "JOURNAL" last July, they have courteously sent us a communication bearing upon the question as they see it after making exploration of the pros and cons of the new form of holder; and permission has been given to refer to the information. They limit their statement to holders of large capacity. Although the same arguments may apply to holders of moderate size, the advantages claimed for the waterless type vary directly with the capacity. In the communication, they attempt to analyze, from the particulars they possess from experience with holders in the United States, what are the comparative advantages of the two types of holder construction—those of the tankless type, as against the standard water-seal type. In doing so, they take step by step the advantages which have been claimed for the former as against the latter.

FOUNDATIONS.

In the first place, a great saving in foundation cost was originally claimed for the tankless type. There cannot be generalization over this question, owing to the varying soil conditions in different localities. It is believed by our correspondents, from available information, that the foundation for the standard type holder is at least no more expensive, and in some cases less so, than for the tankless type, except where the nature of the soil is such that a great deal of long piling is necessary. In respect of one 10,000,000 c.ft. holder, they have been informed that the foundation for the standard type construction figured somewhat less than that for the waterless type. In this case, a standard holder was installed. Where piling is necessary, the foundation for the tankless holder must also have piles, although perhaps not so many. Generally speaking, however, it may be said that where soil will withstand a loading of approximately a ton to the sq. foot, the foundation for the standard type of holder will be less expensive than for the waterless type, due to the deep-spread footing which is put in the waterless foundation.

MAINTENANCE COST.

Proceeding to consider the important question of maintenance cost, the Stacey Bros. Gas Construction Company say the chief advantage claimed for the tankless holder in cold climates is a saving in the cost of heating in winter. This, it will be generally agreed, is in the United States the main source of maintenance expense in the standard holder. Otherwise, the old type of holder operates practically by itself—requiring no frequent skilled inspection—and has been made about as foolproof as any piece of gas-works plant could be. Actual experiences have proved that, contrary to original claims, the maintenance cost of tankless holders has exceeded that of standard ones. This has been due to two causes—first, unforeseen difficulties have been continually cropping-up in connection with the operation of the tankless structures; and, secondly, by intelligent study the cost of heating the standard water-seal holder has been enormously reduced.

DIFFICULTIES.

In the United States, information relative to the difficulties that have arisen in connection with the operation of waterless holders has been meagre; and it is thought likely that there has been some concealment of the facts. In the communication before us, it is suggested that the industry is entitled to the particulars; it is admitted that what information our correspondents have is more or less of a second-hand nature. They also acknowledge that doubtless every one of the difficulties which have occurred could be explained, and possibly means might be devised to prevent recurrence. But it is submitted that, if difficulties have appeared within the two or three years during which tankless holders have been in operation in the United States, it is reasonable to question what may be expected after these holders have been in operation for (say) ten years or more. It is understood by our informants that last winter serious difficulties developed in the waterless holder at Atlantic City. Report has it that the holder was completely out of commission for some little time, and that a condition developed somewhat similar to that of Posen—in that gas escaped above the piston, and a large quantity was lost. If a spark had been produced, who can say what would have happened? The occurrence is described as follows: A pane of glass from one of the ventilators fell from the sash, and lodged in front of the tar seal on a column. This opened up the shoe to such an extent that a large quantity of gas escaped. In the cold weather, the water in the tar had been freezing somewhat; and large pieces of ice were found in the tar seal, also permitting gas to escape. On one side of the holder shell an ice coating had formed, making the shoe on the tar seal ride unevenly, and so allowing a further escape of gas. The tar was so congealed that six of the eight tar-pumps were sucking air. Of course, it is hardly likely that such a thing as a pane of glass falling between the column and the tar shoe would occur again. But this incident seems to prove, among other things, that it is necessary to heat the tar in some manner to make it fluid in cold climates. It is submitted that if this had happened a journey of twenty-four hours from an available crew of repair men, instead of at a point located less than three hours from where a holder of this type was being constructed, it might have had more serious results. Let us repeat that the foregoing information is acknowledged to be second-hand; but it would be interesting to have either confirmation or the exact details regarding the occurrence. It is understood that, shortly after the trouble, the builders sent out an advisory letter to the effect that some means of heating must be provided; and it is believed that a heating system is now being installed on tankless holders.

From other quarters, stories of difficulties with the sealing fluid, the formation of ice, emulsion, and leakage of gas are heard of. One of the first holders of the waterless type to be built in the United States was at Michigan (Ind.); and it would be interesting to hear directly from those in possession of complete knowledge as to the cost of the maintenance of this holder. It is rumoured that it has been very high, in spite of the fact that the builders (so we gather from our correspondents) have had men working on it frequently since its completion. Report also says that the waterless holder at Tampa, Florida, has recently been out of commission due to some mishap.

MORE AS TO MAINTENANCE COSTS.

If maintenance costs are so high on new holders, what may they be in the course of a few years? Besides the cost of operating and maintaining a large number of pumps throughout the entire year, the constant attention to the liquid in the seal, the changing of the character of the liquid (which evidently is necessary) as temperatures vary, and the frequent and careful skilled inspection and supervision required, suggest to our correspondents other possible sources of difficulty and cost. Discussing this point, they say: In the first place, the shell of the tankless type of holder is an assembly of flanged plates, the joints of which are made with some sort of red lead packing. These are not metal-to-metal joints; they are long flat surfaces depending on packing to prevent leakage. They have had ample opportunity to observe the effect of gas, particularly water gas, on red lead packings. Years ago, water-tank holders frequently had leaded joints. Eventually this led to leakage; and the practice was abandoned for metal-to-metal joints. Why then go back to a practice so long condemned? There are the strains of distortion and loosening of the seams in the structure, which may be caused by enormous wind pressures on flat packed surfaces, or the vibration which may be set-up by the movement of the heavy piston. Difficulty of this sort, our correspondents have been told, has occurred on the tankless holder at Flushing, Long Island. At any rate, from observation, there was considerable evidence of tar leaking through the joints; and for some time men were employed making the joints tight. This seems to be a potential source of trouble.

Then, again, consider the light material of which the entire shell of most of the holders is constructed. In many cases, it is understood, it has been less than $\frac{3}{16}$ in. thick. It may, of course, be said that the intermediate sheets of the standard holder lifts are also of light material; but what a small amount, in proportion to the total weight of the holder, these intermediate sheets constitute. The standard holder has a heavy water tank and guide-framing, with an extremely long lift; and

the lifts can be replaced entirely, if necessary, for a fraction of the total holder cost. The tankless holder, however, is likely to act, as our correspondents express it, like the "One Horse Shay"—when it goes, it is likely to go altogether.

Then they indulge in a little speculation by considering the possibility of an objectionable smell arising from the interior of the tankless holder after a period of operation. They say: Consider the large surface coated with tar in contact with gas, and holding its impurities; consider the piston down, and this surface then in contact with the air in the space above, which, though vented, has little real circulation. As the piston rises, this foul air is gradually pushed outward. This may—they do not say "will"—lead to bad odours and complaints.

The Canvas Strip.

While on the subject of maintenance, our correspondents deal with the question of the canvas. No matter how frequent and how careful the supervision, how can the condition of the canvas strip, which is a vital part of the tar seal, be examined? It is not sufficient to say that it will last for ever. It appears reasonable to suppose that many things may happen which will create wear on it; and, if a break does occur, the result might be serious. In other words, in the tankless holders, an explosive mixture above the piston might very well be formed without the actual tilting of the piston. In holders in the States, gas has escaped above the piston, due to ice in the seal emulsion, and various other causes.

A Question of Paint—Automatically Re-Coating Lifts.

There remains the question of paint. How long a coat of paint will last on any holder depends largely on its application. No waterless holder in the United States has been in use long enough to test the paint-lasting qualities. Certainly, if leaks develop through the seams, as is understood has happened, due to the red lead packing, then the painting cost of such holders is apt to be high.

On the other hand, with the thought that is now being given to holder paints, and with the possible further development of non-drying paints which float in the water-tank, and recoat the lifts as they rise and fall, the cost of re-painting the standard type of holder is being greatly diminished.

With some assurance, our correspondents say that the maintenance cost of tankless holders in the United States has been unexpectedly high.

Water-Heating Systems for Ordinary Holders.

An interesting part of the communication of the Stacey Bros. Gas Construction Company deals with some actual data, from United States experience, as to the main item of maintenance cost—heating in winter—of the standard type of water-seal holder. They say:

This is a point which gas suppliers in the South need not be concerned about; therefore, with them, the balance of maintenance cost is overwhelmingly in favour of the standard water-tank holder.

Unfortunately, there has been a great deal of money wasted in heating water-tank holders, and too little attention paid to possible economies. Just what type of heating system is most economical depends a great deal on the peculiar conditions existing; but a few instances of what has been done will suffice to illustrate what may be accomplished in the way of economy.

For a 10 million c.ft. holder at East Chicago (at a pumping-station!) the following method of heating is employed: The amount of gas pumped at this station has averaged during the winter approximately 10 million c.ft. per day; but the compressors have a capacity of 24 million c.ft. per day. At this station, hot water is circulated from the after-coolers on the pumps through the tank and cups. To supplement this, gas-fired boilers are used when necessary to maintain the temperature of the water. During the winter of 1924-25, 6,355,000 c.ft. of gas were used in the boilers. During the winter of 1925-26 only 5,338,000 c.ft. were consumed.

At South Bend, Ind., a hot-water system is employed, using water flow from the holder through condensers, and supplementing this by exhaust steam. Here we believe it fair to say that it costs practically nothing additional in fuel to heat a 3 million c.ft. holder.

The development of holder heating at Fort Wayne, Ind., is interesting. Originally, there was only a 1 million c.ft. holder, which was heated with live steam. A 2 million c.ft. holder was added; and both were then heated by a circulating hot-water system—the water being heated with exhaust steam from the feed-water pumps of the compressor units. The amount of fuel used for heating both holders was then actually some 20 tons of coal less than for the 1 million c.ft. holder alone, when heated with live steam. The next was the removal into another part of the plant of the two 15 million c.ft. per hour pumping units, which had been furnishing the exhaust steam. The holder water was then heated by passing through the primary condensers, supplemented, on a few of the extremely cold days, by a little live steam. The additional cost of heating the two holders is now practically nothing.

At Decatur, Ill., on a 2 million c.ft. holder last winter, a circulating hot-water system was installed, using the condensers as a heating medium, supplemented by two gas-fired boilers thermostatically controlled by the top-cup temperature. There are seven thermometers in this holder, located in the cups and tank; so that the temperatures are carefully watched. Only 49,000 c.ft. of gas were used during the entire winter, the cost of which did not exceed $50.

Similar economies can be, and have been, effected by efficiently designed steam-heating systems. At Decatur, during the winter of 1925-26, the total fuel used was about 50 tons, which, priced at $4 per ton, is $200.

The hot water and steam systems just mentioned do not require any elaborate or skilled supervision; and it must be borne in mind that at most they only operate during the winter months. On the other hand, the maintenance items applying to the tankless holder are an all-the-year-round proposition. Not for a moment can the supervision be neglected, for the very life of the holder, and serious disasters, may depend on difficulties with the seal.

Conclusion.

Summing-up how American gas engineers should view the situation in respect of new and old type holders, the Stacey Bros. Gas Construction Company remark: "Local elements and conditions certainly affect the comparative cost of the two structures. And yet it must be borne in mind that, on the one hand, we have a new, interesting, but potentially dangerous piece of machinery, with a comparatively high maintenance cost, and the possibility of vastly increased maintenance. On the other hand, we have a time-tried, reliable, and safe form of storage for gas which, it is only fair to assume, will cost increasingly less, rather than more, to maintain."

WILTON FURNACE IMPROVEMENTS.

The Chemical Engineering and Wilton's Patent Furnace Company, Ltd., began in 1920 to develop improvements to the Wilton furnace, commencing with the indestructible fire bar, together with equalizing of the draught by the introduction of check dampers, producing a more scientific method of firing. Further developments have recently been made, which should be of considerable interest.

For a long time it had been realized that it was necessary to have an opening at least 3 in. in diameter in the tubes of the furnace, in order to admit sufficient air to each section of the grate for complete combustion. This 3-in. opening supplies the grate from front to back, and of a width approximately 7 in. Therefore, if the grate width should be 3 ft., five holes of 3 in. diameter would be necessary to supply the air for the whole grate. These tubes or holes, which are shaped on the venturi principle, require steam jets to induce air in the venturi tube into the fire bars for combustion.

It was known that successful forced draught induced by steam jets used as much as 4 to 5 p.ct. of the boiler steam; and unfortunately in many cases this was considerably exceeded. After much experiment, it was found that a jet of steam $\frac{1}{8}$ in. in diameter, issuing from an ordinary steam jet projected down the venturi tube, induced sufficient air for combustion purposes in the ordinary forced draught grate; but owing to the angle at which the jet of steam was projected from the orifice of $\frac{1}{8}$ in. diameter, the angle at which the jet impinged upon the venturi tube was found to be uneconomical for the induction of the maximum amount of air. To increase the size of the jet orifice was out of the question, as an increase of steam consumption would be the result; and as the desire was to reduce the steam consumption, the size of the jet had to be reduced.

In fig. 1 is shown the patent jet developed after twelve months of constant experiment, which produced an artificial jet of $\frac{1}{8}$ in. diameter. This artificial jet, when projected into the venturi tube, obtained the desired angle for induction of the maximum amount of draught. With this specially constructed jet, it is possible to realize the same draught with a jet of steam of 0·085 in. diameter as it was with the old jet of $\frac{1}{8}$ in. diameter; and this uses only $2\frac{1}{2}$ p.ct. of the boiler steam. The saving from this can easily be calculated in the simple formula herewith. From practical results, it was found that, on a Lancashire boiler (26 ft. by 6 ft. 6 in.) developing its maximum output over a period of 24 hours, exactly half a ton of fuel per day of 24 hours was saved by the installation of these jets, over the old type of jet; and as a result of this the whole plant was fitted with the new jet.

$$W = \frac{6\,AP}{7}$$ in which W = weight in pounds of steam.

A = area of the orifice in sq. in.
P = absolute pressure
K = the constant, in this case 0 93.

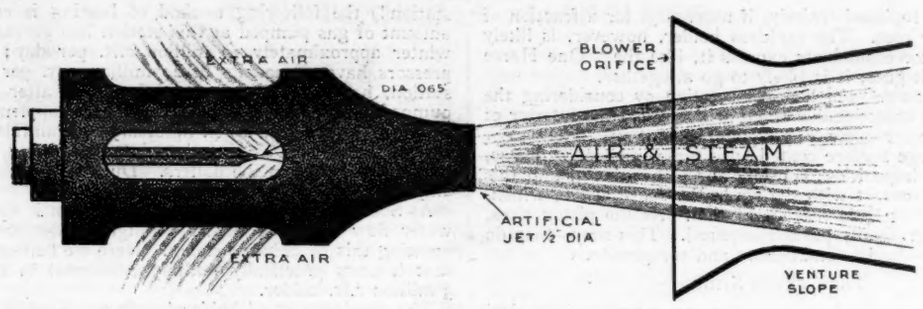


FIG. 1.

K is the constant used for a short pipe or opening where the steam issues into atmospheric pressure.

Results worked out on the formula are as under:

Jet 0·125 *in. dia.* (*Old Type*).	*Jet* 0·085 *in. dia.* (*New Type*).
Area of orifice . 0·01227 sq. in.	0·005676 sq. in.
Absolute pressure 115 lbs. per sq. in.	
$W = \frac{6 \times 0{\cdot}01227 \times 115 \times 0{\cdot}93}{7}$	$W = \frac{6 \times 0{\cdot}005676 \times 115 \times 0{\cdot}93}{7}$
= 1·0331370 lbs. per jet. per min.	= 0·5203 lb. per jet. per min.
= 8·2651 lbs. per boiler per min.	= 4·1624 lbs. per boiler per min.
= 495·9 lbs. per boiler per hour.	= 249·7440 lbs. per boiler per hour.

Assuming that the furnaces are two of the four-way type, then the total number of jets equals eight.

To compare steam used on the whole boiler, the above formula should be applied to calculate the steam used by each jet, and multiplied by the number of jets. Thus a furnace may have a jet of the same diameter as the Wilton, but (say) ten of them for similar grate area; and the Wilton may have only six.

From these calculations, it is obvious that the amount of steam used by the old type jet is practically double that used by the new type. In order to compare the amount of fuel that can be saved by adopting the new jets, it is necessary to calculate the exact quantity of fuel required to produce the necessary steam for them. Assuming that 1 lb. of steam at 100 lbs. pressure is 1185 B.Th.U.; that the actual value of the fuel is 9000 B.Th.U.; and that the efficiency of the boiler is 70 p.ct., the total amount of fuel required to supply the necessary steam for the old type jets would be:

$$\frac{495{\cdot}9 \times 1185 \times 100}{70 \times 9000} \times 24 \text{ lbs. fuel per day,}$$

and for the new type, 0·085 in. bore—

$$\frac{249{\cdot}7 \times 1185 \times 100}{70 \times 9000} \times 24 \text{ lbs. fuel per day.}$$

Saving in fuel on one day's working, 1111·6 lbs., or (say) 10 cwt. per boiler per day.

Assuming that there are 200 working days in the year per boiler, this would give 100 tons of fuel saved per annum.

The most recent development has been at the back end of the furnace, known as the blank end. At this point combustion should be complete. But unfortunately this is not the case in a number of instances; and an observer has only to notice chimneys from factories pouring out black smoke, to realize that combustion is by no means complete in the boiler house. A number of developments have been introduced to the market, whereby extra air is conveyed to the back of the furnace near the bridge, in order to burn this smoke (which otherwise would pass away as unconsumed fuel), but without very great success.

The latest development, however, of the Wilton furnace, for which a patent has been recently granted is known as the sloping blank end, and is a very important advantage to the general principles of inducing air at the back of the furnace. With these sloping blank ends, air is projected into the boiler tube at an opposite angle to the draught from the burning fuel. This extra air is introduced at an angle carefully arranged to produce a cyclone or whirling action of the smoke itself; and thus the smoke is made to hesitate at this point. The sloping blank end, provided with fire bricks, is in an incandescent state; and at this point the whirlpool of gases containing the smoke is brought into violent contact with the warm air induced by a steam jet controlled at the front of the boiler. This mixture near the incandescent brickwork completes the smoke combustion, and adds considerably to the efficiency of the working of the furnace; and as much as 10 p.ct. increased efficiency can be attained. The sloping blank ends further provide a check on dusty fuel being carried over the bridge by the cyclone action.

As a third useful claim for these blank ends, it may be mentioned that, when the boiler is cleaned or clinkered, the furnace doors have to be opened; and of necessity a certain amount of cold air passes into the boiler tubes through the firedoor, thus impeding the evaporative capacity of the boiler. The utility of these sloping blank ends can be further increased by the fireman pushing the live fuel on to the sloping surface, and there actually burning the fuel by the extra air provided and controlled at the front. This effectively puts up a screen against cold air travelling into the boiler through the fire tubes, and at the same time provides a means for the fireman to clinker the grate effectively without seriously impeding the combustion. The live fuel is afterwards drawn back on to the fire bars.

In fig. 2 a diagram indicates the exact action of the cyclone of air which is induced at the blank end, and the smoke as it is actually burned on the bridge.

Fig. 3 shows the live fuel pushed on to the sloping blank end,

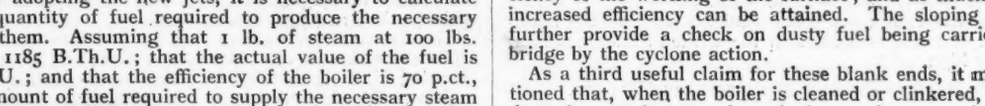


FIG. 2.

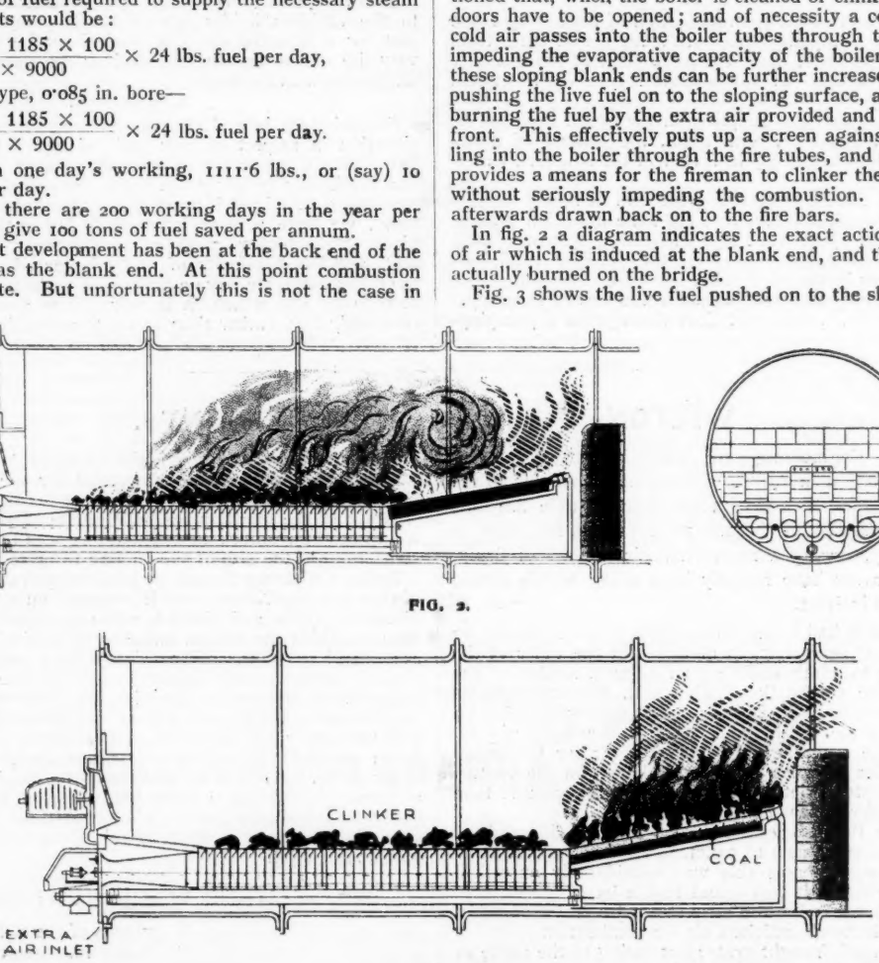


FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

and burning freely with the assistance of the extra air controlled by the fireman at the front of the boiler. The fire door is open; and the fireman is easily able to effect the clinkering without seriously impeding the steaming capacity of the boiler.

Figs. 4, 5, and 6 show three chimneys. No. 4 is pouring out black smoke, where there is no smoke consumer fitted; while there is obviously a considerable amount of fuel being wasted. Fig. 5 shows smoke emanating from a similar chimney while the fireman is cleaning the fires, with a smoke consumer fitted. Fig. 6 illustrates a similar chimney with smoke consumer fitted, and the fireman actually stoking green coal on to the fire; the smoke being consumed down to comparatively nothing.

These sloping blank ends can be fitted to old-type furnaces in a few hours, and are made in three standard sizes—suitable for the firm's three-way, four-way, and five-way furnaces.

INDICATING GAS PRESSURE FROM A DISTANCE.

The "Aegir" System.

Absence of floats, contacts, and batteries; connection direct to the supply mains; accuracy of readings; reliability in working; only one connecting wire; small space required; no attention needed—these are the advantages claimed by Messrs. Isenthal & Co., Ltd., of Victoria Road, North Acton, for their "Aegir" system of indicating gas pressure from a distance.

Action of the Indicator.

The action of the "Aegir" remote control indicator is based on the measurement of the current in an electric circuit when the resistance of the circuit is varied at one particular point. This variation is brought about by the degree of immersion of a high resistance suspended in water. The resistance element is mounted close to, but is insulated from, a metallic support; and this reduces the resistance of the liquid through which the current has to pass. To prevent electrolytic action, the current employed is alternating. The indicating instrument takes the form of a special milliammeter.

The indication can be made either by an ordinary dial instrument or by a recording device in which the variations of pressure are recorded on a clockwork-driven chart. It is possible to combine a number of these instruments with the transmitter, to have multiple control; and it is also possible to switch the central control instrument on to a number of transmitters situated at various points in the distribution area.

Warning Devices.

The indicators can be combined with electric contact devices which, by acoustic and visible signals, give warning when the pressure has fallen too low. For this a Wheatstone bridge is used; the action of the alarm signal depending on the balancing of the bridge. In the case of an acoustic device, provision can be made, once the signal has been given, to discontinue it, though it would be ready for the next impulse without adjustment.

The simplicity and compactness of the transmitting unit can be seen from the illustration. The pressure of the gas upon a column of water varies the level of this water in the inclined limb of a container, and this alters the amount of immersion, and hence the available resistance of the rod contained in this limb. The material of the rod is proof against chemical influences. The dimensions of the resistance and the design of the level are so adjusted that changes in the conductivity of the water, and also the influence of the connecting line between the transmitter and the indicating instrument, do not alter the readings even over long distances. The apparatus is fitted with a level gauge, the necessary taps, and a separate level for the control of zero point.

Absence of Attention.

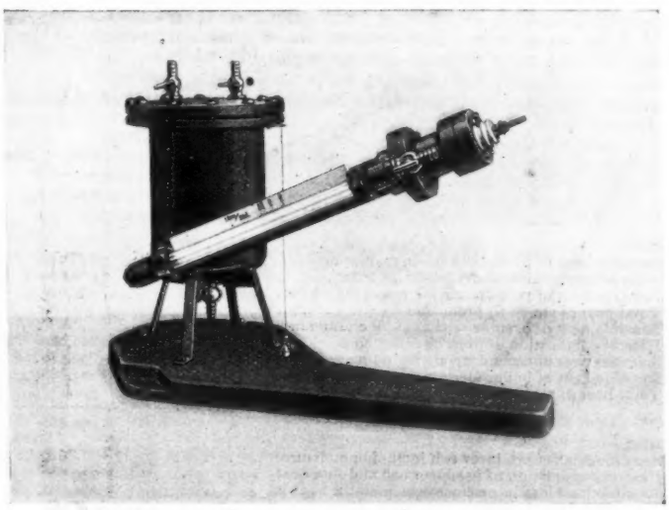
Messrs. Isenthal state that the installation requires no attention, because, if for some reason an interruption in the circuit should take place, the indicating instruments will resume their correct readings when the current comes on again, and there is no need to readjust the resistance. As the level rod is fixed, no mechanical inertia comes into play, and rapid alterations in the pressure of the gas can be indicated.

Temperature variations do not affect the readings, which are equally dependable during frosty weather, because the liquid round the level rod cannot freeze, owing to the passage of current.

Other Applications.

In an interview with the makers, when we saw the instrument in operation, we learnt that, by a simple attachment, the "Aegir" device can be made to indicate and record the flow of gas in any main in the distribution area or in any pipe on the works.

Another interesting application for which the instrument is suitable is to record at the central plant the position of the lifts of any of the gasholders in the district which may be used for augmenting the pressure at various points. By this means, boosters at the main plant can be brought into action immediately the recorder shows that the supply of gas at the holder sub-station is being unduly depleted by excessive consumption in that district.



THE "AEGIR" GAS PRESSURE APPARATUS.

AMERICAN GAS ASSOCIATION.

Notes from Reports and Papers—First Article.

CARBONIZATION COMMITTEE.

The report of the Carbonization Committee occupies nearly 150 pages, and is accompanied by appendixes, one of which alone fills another 100 pages. As a matter of fact, the various sections of the Committee have during the year under review carried out a great deal of work, under Mr. A. M. Beebee, of Rochester (N.Y.), as General Chairman. Every effort has been made to carry out an impartial, unbiased investigation to determine the characteristics of the various types of plants and the resultant cokes under similar conditions, all using coal from the same mine. The entire lack of any such information made an investigation of this kind imperative, since coal carbonization is becoming an extremely important economic subject. It happened also that there were a number of contributing factors which made a study of this nature desirable at the present time. Work has been done on horizontal retorts, coke ovens, and intermittent verticals; and as this leaves the continuous vertical type of plant still to be dealt with, the Committee wish to continue their labours over another year.

So far as they have gone, the Committee remark that it has been a happy coincidence to find that, when considered on an over-all thermal basis, there is a marked closeness of results; and that it would seem, therefore, that a prospective plant purchaser should devote more time to considering initial investment, probable life of plant, operating labour costs, and maintenance charges. The coke study work should also be a guide to him, in showing the characteristics of the resultant cokes, and indicating which type of plant would more completely fill his particular local market needs. Acknowledgment is made of the assistance of the Bureau of Mines and the Massachusetts Institute of Technology; as well as of the help given by the Pittsburgh Coal Company, who rendered the tests possible by making a price concession on the coal, so that the plant using it would not be out of pocket thereby.

SUMMARIZED HEAT BALANCES.

The first appendix to the report deals with heat balances at Lowell, Utica, and Rochester. At Lowell, there are Russell Engineering Company's through horizontal retorts; at Utica, Koppers coke ovens; and at Rochester, U. G. I. small type intermittent verticals. Throughout quantities are based upon one 2000 lb. ton of dry coal charged; all heats of combustion of gases and solids, as well as heat quantities of steam, are gross, including always, therefore, the heat of condensation of any water involved; and all sensible heat quantities, as well as heats of combustion, are given, using 60° Fahr. as a basis. The comparative summarized over-all heat balances are shown in the accompanying table.

DRY COKE QUENCHING PLANT.

With a view to securing a method of dry cooling coke that would be less expensive in construction, more compact, and require less mechanical equipment and labour to operate than is the case with the European systems now in use, the U. G. I. Contracting Company have brought out a dry quencher, which is a combination of the standard coke wharf with a boiler setting. A 50 H.P. unit is in operation at the Company's Syracuse (N.Y.) plant, undergoing tests; and the preliminary results, the Committee say, look very promising. The coke is of a uniform grey colour, not intermixed with the black lumps usually present with water-quenched coke. In addition to this, it is more uniform in size, with less fines, thus reducing the quantity of breeze.

The following results were obtained in a test made in June on the U. G. I. dry coke quencher:

Total coke charged	349,346 lbs.
Total feed water metered	1313·5 c.ft.
Temperature feed water	54° Fahr.
Boiler pressure	121 lbs. per sq. in.
Evaporation factor	1·21
Boiler horse power	34·5
Evaporation per lb. coke actual	0·235 lb.
" " " from and at 212°	0·284 lb.
Tons coke cooled per hour	2·1
Horse power developed per ton of coke per hour	1·64

LOW-TEMPERATURE CARBONIZATION.

Several papers dealing with different aspects of low-temperature carbonization are included in the report. Mr. H. C. Porter, the author of one of these, says it can hardly be held that any plant, in Europe or America, is now operating commercially (except perhaps the German brown coal treating plants); but several in America appear to be on such a scale, and in such a stage of construction or experimental operation, that they promise early commercial development. These are, notably:

The McEwen-Runge process at Milwaukee.
The Piron-Caracristi process at Walkerville (Ford Motor Company).
The McIntire new three-stage process at Fairmont
The Greene-Laucks process in Franklin County.
The Parr process at the University of Illinois, Urbana.

As far as the gas industry is concerned, there is little effort being made to apply low-temperature carbonization to its needs or purposes, except in one or two cases incidental to the main purpose of the carbonizing project. Mr. A. W. Warner's process, however, which is under trial at Petersburg (Va.), in a unit of commercial size is an exception to this, being an attempt to apply low-temperature carbonization,

Comparative Summarized Over All Heat Balances—Utica, Rochester, and Lowell Plants.

	Utica.		Rochester.		Lowell.	
	B.Th.U.	P.Ct.	B.Th.U.	P.Ct.	B.Th.U.	P.Ct.
Input—						
Sensible heat of producer coke including moisture	940	0·00	980	0·00	160,000	0·50
Heat of combustion of dry producer coke	3,608,670	11·25	3,942,850	12·09	2,970,000	9·37
Sensible heat of primary air including moisture	25,610	0·08	26,590	0·08	7,120	0·03
Total heat of steam to producers	165,000	0·51	191,000	0 58	182,600	0·58
Sensible heat of oven or retort coal including moisture	..	..	11,200	0·03	2,580	0·01
Heat of combustion of oven or retort coal	28,266,000	88·07	28,400,000	86·93	28,268,000	89·33
Sensible heat of secondary air including moisture	32,540	0 10	19,580	0·06	20,270	0·06
Sensible heat of boiler feed water or producer jacket water	−1,880	−0·01	53,100	0·16	37,700	0·12
Total heat of steam to retorts	..	..	23,550	0·07	..	..
Total heat input	32,096,880	100·00	32,668,850	100·00	31,648,270	100·00
Output—						
Sensible heat of producer ash including moisture	610	0·00	770	0·00	560	0·00
Heat of combustion of producer ash and flue dust	239,580	0·74	248,930	0·76	47,100	0·15
Sensible heat loss in producer gas main or cooler	254,990	0·79	16,700	0·05	..	..
Total heat of seal water	17,260	0·05	..	..	..	..
Total heat of producer jacket steam or cooling water	223,000	0·69	166,200	0·51	..	..
Sensible heat of dry oven or retort coke	1,112,710	3·46	1,096,870	3·36	1,039,900	3·28
Heat of combustion of dry oven or retort coke	17,872,920	55·70	18,403,210	56·30	17,780,000	56·20
Sensible heat of dry coal gas including hydrogen sulphide	285,620	0 89	199,200	0·61	284,390	0·90
Total heat of water in coal gas	244,400	0·76	190,490	0·59	207,000	0·65
Heat of combustion of dry coal gas	6,496,300	20·25	6,127,380	18·76	6,563,620	20·72
Sensible and vaporization heat of tar	55,300	0·17	41,600	0·13	52,450	0·17
Heat of combustion of tar	1,887,940	5·87	1,858,000	5·70	1,837,700	5 81
Total heat of ammonia	66,700	0·21	61,200	0·19	52,300	0·16
Heat of combustion of hydrogen sulphide	44,800	0·14	44,800	0·14	47,600	0·15
Sensible heat of dry waste gas	580,000	1·82	587,000	1·80	522,000	1·65
Total heat of moisture in waste gas	198,750	0·62	335,600	1·02	256,500	0·81
Heat of combustion of waste gas	70,500	0·22	17,600	0·05	..	..
Total heat of waste heat steam	198,700	0·62	652,000	2·00	290,000	0·92
Total heat of waste heat boiler blow down	1,920	0·01	9,580	0 03	1,920	0·01
Heat of combustion of diluent producer gas	76,760	0·24	..	..	..	..
Total radiation and convection losses	359,300	1·12	1,084,600	3·33	1,088,000	3·44
Unmeasured heat loss	1,808,820	5·63	1,527,120	4·67	1,577,230	4 98
Total heat output	32,096,880	100·00	32,668,850	100·00	31,648,270	100·00

modified so as to embody some high-temperature features, primarily to gas making. But, for application to gas manufacture, low-temperature carbonization has serious economic difficulties to meet, in the competition of already well-established processes, which at present equal, or exceed, it in overall thermal efficiency and in yield of gas B.Th.U. per unit of cost, and meet more easily also the public requirements as to grade of gas.

SOME INDUSTRIAL USES OF GAS.

By invitation of the Gas Light and Coke Company, a meeting of the Institution of Engineers-in-Charge was held in the lecture hall of the Church Street, Kensington, Showrooms, on Monday evening, Nov. 29, when, under the Chairmanship of Mr. F. W. Goodenough, C.B.E., a paper on "The Uses of Gas in Industry" was read by Mr. J. Ennals, a member of the Company's staff.

Though unable, in the time at his disposal, to do anything more than generalize on the various trade processes with which the Company meet in their area of supply, the author showed clearly how great is the dependence on gas of the manufacturing community.

For some of the many processes to which he made reference the Gas Light and Coke Company have designed and installed special apparatus; but where standard appliances are the best for the job under consideration, they have no hesitation in recommending their use. The following details of a few of the applications enumerated are extracted from the paper.

Aluminium Founders.

Gas-fired aluminium melting furnaces are by no means a new departure. Twelve were installed in a London foundry during the war, and are still in use to-day. These furnaces are of the hearth type, are brick lined, and are 5 ft. long by 2 ft. in diameter, each being capable of dealing with a 230 lb. charge. The burners are of the open-mouth type, with gas at ordinary pressure, and air blast which is generated by open type blowers. The first melt of 230 lbs. of metal is carried out in about 1¾ hours, starting from cold; successive melts being much more rapid. The furnaces are capable of dealing with either fresh ingots or sweepings and scrap. The blast burners are not situated beneath the furnace, but play directly on top of the bulk of metal, which, when melted, runs to the bottom. The furnace is then tilted or turned on its axis, and the metal poured into moulds. There are other smaller furnaces of the crucible and pot type in use by manufacturers of small aluminium castings.

Owing to the chemical action of aluminium on wrought iron, the Company have found it necessary to have fairly stout pots to stand up to the work. Some manufacturers use plumbago pots with crucible furnaces for small charges up to about 28 lbs.

Cycle Making.

There are several manufacturers of cycles in London who construct their own frames. The first operation is brazing, by which the bottom brackets and head stems are built into the diamond frames. This is done by ordinary gas-fired brazing blowpipes and brazing hearths.

The next heat process is stoving, after the frames have been coated with enamel or dipped and lined. Stoving or enamelling ovens of various sizes are heated either internally (by bar burners fitted inside the oven, suitably protected by drip shields, which also act as heat diffusers) or externally (by burners fitted between the inner and outer cases, when the products of combustion are carried round the oven without coming into contact with the work). Where the latter condition is desired by a customer who has an ordinary single-cased oven in use, it is not necessary for him to purchase an externally heated oven, because the Company have designed what they call box or tubular heaters, which they fit inside the ovens, with flue ducts carried up the sides in serpentine formation. These ducts radiate heat, and carry the products of combustion outside the oven.

Cabinet Making.

Veneering is again coming into favour in cabinet making. The sheets of veneer, after being glued, are affixed to the wood foundation; and then heated sheets of zinc—known as cawl plates—are placed upon them, and the whole clamped together. These cawl plates were formerly raised to the required temperature over flue pipes heated from slow combustion coke stoves. The Company were asked to design a suitable gas-fired plate heater, which their chief industrial representative successfully accomplished; and he now constructs a large number of these cawl plate heaters at the workshops in Goswell Road. The Company have just installed one 10 ft. long by 4 ft. 6 in. wide, for one of the leading cabinet makers in the country.

Steaming wood, prior to glueing and bending, is a further process in which gas has been employed with great success. One such apparatus, installed for a manufacturer of baby grand pianos, consists of a gas-heated tank steam generator, with steam ducts led into an upper chamber, where the laminations are saturated with steam before they are glued up, and are then bent round a jig to the required shape.

Brush Making.

Washing and sterilizing bristles for shaving brushes is now universally carried out under the regulations of the Board of Trade. In connection with this process, the Company carried out an interesting experiment in a brush works. A tank of 225 gallons capacity was fitted with gas burners, having a maximum hourly consumption of 300 c.ft. (1½ therms). Bundles of bristles were immersed in the tank, which contained a disinfecting solution; and the contents were raised to a temperature of 130° Fahr. in one hour. There are other makers who are using smaller units in very much the same way in the sterilizing of bristles for tooth brushes.

A special tooth brush drying oven which the Company construct is of the single-cased type, and is made with wooden racks to slide into the oven, after they have been loaded with the completed brushes. This apparatus materially increases the speed of drying before packing, and is therefore of great importance to the manufacturers.

Varnishing and Polishing Rooms.

The heating of varnishing and polishing rooms has frequently presented a problem to manufacturers, because vapours or smoke rapidly spoil the appearance of finished articles such as brushes and walking sticks. The Company have successfully overcome this difficulty by the introduction of a specially designed gas heater, which, while its heating chamber is inside the room, is lit from the outside. The flue duct for the removal of the products of combustion also passes through, and assists in heating, the room before discharging into a shaft, or, if satisfactory, into the open air.

Bottle Drying.

Bottle drying has long been a problem for confectioners—and, indeed, for all others who wash bottles prior to packing. The old method—a long and tedious one—was to place the bottles on racks in the open air. This has gradually been superseded, first by the use of gas heated drying ovens, and recently by a novel method which was introduced by one of the author's colleagues. This apparatus consists of a rectangular air-heating chamber, beneath which are fitted powerful bunsen burners. Cold fresh air is induced into the chamber by a motor or belt driven fan. Nozzles are fitted vertically to a plate which covers the chamber. The wet bottles are placed over the nozzles, through which the heated air is projected into them, passing over the whole inner surface, and thence out at the neck. It has been proved that, when this type of bottle dryer is used, a certain sized bottle can be dried in three minutes which formerly took about two hours in a drying oven, or eight hours if left in the open air.

Drying Lacquered or Bronzed Goods.

Ovens for drying lacquered or bronzed goods can now always be successfully operated by gas, although until fairly recently it was thought that such processes could only be carried out by ovens heated by electricity or steam, owing to the inflammability of the spirit-sprayed articles. The Company recently carried out a very successful conversion from electricity to gas in two drying ovens, each about 6 ft. by 4 ft. by 4 ft., the installation fulfilling all the rigid requirements which were laid down by the London County Council. In this case no flames could be permitted to burn within the oven; and the Company therefore constructed and fitted in its interior a closely welded box combustion chamber. A bunsen burner of the bar type was then inserted through the side of the oven into the box heater. This burner is ignited from the outside, and the products of combustion are carried away through a flue to the exterior of the oven, giving up a proportion of their heat in transit.

The consumer subsequently wrote that his working costs had been very considerably lowered, though his output was increased. "I can," he said, "dry off a batch of work in seven minutes with gas which took thirty minutes with electricity; the cost being about five to one in favour of gas, apart from the fact that I can now deal with four times the amount of work in a given time, which, I need hardly say, speeds up my production."

Electrical Equipment Makers.

As an illustration of the dependence of one industry upon another, the author mentioned that some of the Company's largest users of gas are the electric lamp manufacturers. The General Electric Company, at their Osram Lamp Works, were,

he understood, the largest consumers in the late Brentford Gas Company's area of supply, and are now the biggest industrial consumers in the Gas Light and Coke Company's whole area. The operations in the main consist of playing gas flames (by blowpipe) on to glass tube for shaping bulbs. After shaping the bulb, the bottom has to be cracked or cut off. This is done by a rotating machine having very sharp high-pressure gas flames, with knife-cutting edges, fitted at regular intervals round the machine. After manufacture, the bulbs are exhausted by a heating and vacuum plant; the heat being provided by normal pressure gas burners.

The Western Electric Company are also very extensive consumers of gas, for the various processes connected with the manufacture of cables.

CHAIN ANNEALING.

All crane chains have to be periodically annealed; and the difficulty of satisfactorily carrying out this process, and the delays incidental thereto, are well known. The old method of heating by a breeze forge, and passing chains section by section through the fire, was a very tedious operation. At the request of the Engineer's Department at the Beckton Works, the Company's chief industrial representative designed a gas fired travelling chain annealing furnace, 8 ft. long by 12 in. wide. This furnace is fitted with a series of gas and air blast burners, so placed that their flames are directed on to the chain, as it is slowly drawn through at the rate of just over 1 ft. per minute. A small motor is fitted at the delivery end, and the speed of travel is regulated by suitable gearing. The operation is carried out by one man, who packs the chain into a large iron bucket, where it is covered over and left to cool down. A chain 370 ft. long, made up of 1-in. rod was annealed in this way in five hours, whereas by the old method the same chain used to take three men three days to anneal.

GAS HEATING AND COOKING IN A HOSPITAL.

In conclusion, the author departed somewhat from the subject of his paper to give his audience (among whom were men in charge of large institutions) some details regarding the extensive gas installation in the recently-reconstructed Westminster Hospital.

About 500 mid-day meals are prepared and cooked each day in the main kitchen, wherein may be found a number of gas cooking stoves. A modern gas cooking stove is also installed in each of the sixteen ward kitchens. It is worthy of note, too, that a gas cooking stove is fixed in the lecture room, where invalid cookery is practised by the nurses. After long and careful consideration had been given by the authorities to the method by which the building was to be heated, it was decided to instal gas fires in every general and private ward, and in the sitting rooms of the resident medical staff, the offices of the matron, the nurses' rest and sitting rooms, and in every one of the bedrooms in the nurses' homes, a short distance from the hospital.

The total list of gas fired appliances in use in the hospital and the nurses' home is as follows: 180 gas fires; 4 gas radiators; 4 gas condensing stoves; 19 gas cookers; 1 gas griller; 1 gas heated hot closet; 3 gas hotplates; 1 demonstrating table with recessed gas hotplates; 50 gas boiling rings (used for sterilizing instruments, &c.); 10 sterilizing burners (in operating theatres and in out-patients' consulting rooms); 1 gas carving table with covers and bain-marie.

WHAT INDUSTRY OWES TO THE GAS UNDERTAKINGS.

Mr. Goodenough, after extending a cordial welcome to the Institution, drew attention to the indebtedness of industry to the gas undertakings of the country for having maintained an uninterrupted supply of heat, power, and light during the seven months of the coal stoppage—an indebtedness the extent of which he feared that the general public are far from realizing. Though, as he said, the gas industry does not claim any special credit for this, it is a source of gratification to all connected with it to know that they have not let down business people in any part of the country during this time of trouble. The basis of the policy of the Gas Light and Coke Company, as of that of all progressive undertakings, is the satisfaction of the consumer. Their chief desire is that everybody should use gas in the most economical manner possible; and they are endeavouring in every factory, workshop, and home in their district to secure the constant, as well as the initial, efficiency of their apparatus.

GAS IRON EFFICIENCY.

As one in charge of institutions consuming a considerable amount of gas, Mr. Dawson (the Chairman of the Institution) said he has in some cases found it most useful and economical, where other means have also been tried. A few years ago, in the ward kitchens of a certain hospital, they were using ranges which consumed a quantity of coal out of all proportion to the results obtained from them. These were replaced by gas hotplates which were much more suitable for the work required of them, and the cost was not one-quarter of what had previously been paid for coal. Again, some twelve months ago he was particularly interested in gas irons. He has tried electric irons, irons heated on coke fires, and high-pressure gas irons, and has found the last-named superior to the other two. The cost of gas is less than that of coke for irons. Electric irons are good provided one does the same kind of work all the time; but the gas iron can be easily regulated to the weight of goods that are being ironed. He has, indeed, found them so satisfactory that he is putting in more..

COMPARATIVE COSTS OF GAS AND ELECTRICITY FOR COOKING.

Replying to a question of Mr. A. E. Penn (the Hon. Secretary of the Institution) as to the comparative costs of gas and electricity for cooking, Mr. Goodenough said that careful tests, made with the desire to give every possible advantage to electricity, have demonstrated to the Company that, if you take the price of gas per therm and divide it by 24, you will arrive at the price at which electricity will have to be supplied to compete with gas for cooking in all the different processes involved for a family or institution. If the price of gas is 8d. per therm, one will have to pay ⅓d. per unit to get electricity at the same cost.

The author was heartily thanked for his paper, as were the Gas Light and Coke Company for their hospitality; and after light refreshments had been served, an inspection was made of the showrooms.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organizations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Dec. 9.—MURDOCH LODGE NO. 3480.—Meeting at 4.15.
Dec. 14.—NATIONAL GAS COUNCIL.—Meeting.
Dec. 14.—FEDERATION OF GAS EMPLOYERS.—Meeting.
Dec. 14.—NEWCASTLE-ON-TYNE SECTION OF THE SOCIETY OF CHEMICAL INDUSTRY.—Meeting at Armstrong College, at 7.30. Paper by Mr. L. H. Sensicle on "The Future of High-Temperature Carbonization."
Dec. 15.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS (EASTERN DISTRICT).—Meeting at 28, Grosvenor Gardens, S.W. 1, at 2.30.
Dec. 16.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting at Birmingham. Paper by Mr. A. Knight.
Dec. 17.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute. Paper by Mr. C. M. Croft.
Jan. 7.—INSTITUTION OF MECHANICAL ENGINEERS.—Informal meeting, to discuss "Developments in the Carbonization of Coal," to be introduced by Dr. C. H. Lander, 7 p.m.
Feb. 16.—"B.C.G.A." MIDLAND DISTRICT CONFERENCE.

INSTITUTION OF GAS ENGINEERS.

Dec. 13.—Emergency Committee, Finance Committee.
Dec. 14.—Advisory Committee on Education.

Developments in the Carbonization of Coal.—At an informal meeting of the Institution of Mechanical Engineers, on Friday evening, Jan. 7, Dr. C. H. Lander will introduce for discussion the subject of "Developments in the Carbonization of Coal."

Explosive Reactions in Gaseous Media.—A general discussion on this subject was held by the Faraday Society on June 14—see "JOURNAL" for June 30, p. 735. The Society have now published the various papers and the discussion on them, in book form, the price being 10s.

"Gas Meters."—Messrs. Crosby Lockwood & Son inform us that they will shortly publish the Second Edition, Revised and Enlarged, of "Gas Meters," by A. T. Gilbert. This book deals with the construction, use, fixing, inspection, and maintenance of gas meters, and has been written for engineers, managers, inspectors, fitters, and students. In the new edition the author has added particulars of improvements recently made in gas meter construction, and has included further illustrations.

Imperial College Association.—The annual dinner of the Imperial College of Science and Technology—Incorporating the Royal College of Science, the Royal School of Mines, and the City and Guilds (Engineering) College, South Kensington—will take place at 7.30 on Monday next, Dec. 13, at the Hotel Cecil. The chair will be taken by Sir Thomas H. Holland, Rector of the College.

High-Temperature Carbonization.—At a meeting of the Newcastle-on-Tyne Section of the Society of Chemical Industry, to be held in the Chemical Lecture Theatre, Armstrong College, next Tuesday, at 7.30, Mr. L. H. Sensicle will read a paper on "The Future of High-Temperature Carbonization." It will be illustrated by lantern slides. The meeting is being held under the auspices of the Fuel Section of the Society; and several members of the Fuel Section Committee are expected to attend. A cordial invitation is extended to the members of the Coke Oven Managers' Association and the North of England Gas Managers' Association.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Joint Committee on Tar.

SIR,—Practically every interest in the tar producing and using communities in this country was well represented at the Tar Conference held in Manchester on Friday, Nov. 26, when the following resolution was unanimously adopted:

> That the Joint Committee consisting of the Fuel Section of the Society of Chemical Industry, the Coke Oven Managers' Association, and the Institution of Gas Engineers be requested to devise means for the formation of a representative committee which shall standardize as far as possible the methods of testing tar and its constituents.

It was generally agreed that the Committee which would eventually deal with the matter should be as representative as possible; and it will be the aim of the Joint Committee to ensure this.

This letter will be sent to all those who are thought to be interested in the subject, but it is certain that many will be overlooked; consequently its appearance in the Technical Press is an invitation for them to communicate with the Hon. Secretary (address below).

As a first step, all chemists and others who are interested in the subject of the standardization of methods of testing tar and its products are requested to communicate with the Hon. Secretary, informing him of the particular tests that they individually have in mind which require standardization. The Committee will then not only have a starting point, but they will also be put into communication with all those who are showing an interest in this subject, and will be in a better position to make a representative selection without serious omissions than if they depended on their own immediate experience and knowledge.

The Committee will be meeting within the next fortnight; and it is advisable that as many communications should be received prior to their meeting as can conveniently be made in the time.

E. W. SMITH,
Joint Hon. Secretary of the Joint Committee.

Allington House,
Victoria Street, S.W. 1.
Dec. 1, 1926.

"Where are the Students?"

SIR,—Permit me to present you with an answer to your question.

(1) There is no lack of interest on the part of students, as over the past two years I have been been in touch with upwards of 500 would-be candidates for the examinations conducted under the Education Scheme.

The fact to be faced is that only a fraction of these find it practicable to proceed further than making inquiries. Several reasons can be given for this, and I propose to deal with them in the form of simple statements giving the facts upon which they are based.

(2) There is a great lack of facilities for obtaining the requisite training in the ancillary subjects in the manner specified in the regulations—that is, at technical schools. This will be clear from the following.

According to List 111, 1922-23, of Technical Schools, ignoring the London area, which possesses exceptional facilities, there are but 53 technical schools in England and Wales with courses of instruction in the three subjects mechanical engineering, building construction, and chemistry; twelve schools also have courses in two of these subjects, one of which is chemistry, while eleven others have courses in mechanical engineering and building construction. A knowledge of chemistry is vital to the study of gas engineering or gas supply, so it may be taken that there are but 65 schools available for recognition as fully "approved schools" under the main scheme in England and Wales. A hundred-and-one schools have been taken from this list, and included in the published "Abbreviation of the Education Scheme;" but in considering these, it is necessary to bear in mind that they cannot all supply instruction in the ancillary subjects to the standard required for the Higher Examination. This introduces the point, Is it reasonable to expect students to attend technical schools for training in the ancillary subjects, when they know that, having reached the standard required for the Ordinary Certificate, to complete their training, they must find employment at a works more favourably situated?

There are, of course, other minor technical schools in various parts of the country, but they are not considered to be of sufficient importance to warrant inclusion in the above list, so that it may be taken that the standard at these schools is too low to be of greater service than for the preliminary stages.

If you take a map of England and Wales, and describe a ring with a 5-mile radius round each of these schools, you will find that they are capable of serving an average of 4 gas-works each. We have, therefore, taking the best possible figures, the prospect of the scheme developing to serve efficiently $65 \times 4 = 260$ undertakings.

There are approximately 1170 undertakings in England and Wales (ignoring the London area), so that we have $1170 - 260 = 910$ undertakings for which there does not appear to be any possibility of adequate facilities, and for the greater number of these none whatever, so far as the examinations of the Institution are concerned.

A further point which arises from these considerations is that only the largest undertakings can guarantee a steady stream of students, year after year, sufficient to maintain classes in the main subjects at a technical school. At Halifax, for example, it has been found possible to run classes at intervals from 5 to 7 years. That is to say, it is necessary to allow students to accumulate.

(3) There is endless confusion in respect of the requirements in the ancillary subjects owing to the fact that in no two technical schools is the standard precisely the same in the various subjects taught in a given year, although in some cases there may be a striking resemblance.

Hence the necessity to obtain the approval of the Advisory Committee of a particular course of study in cases where "approved" courses have not been instituted. It follows from this that there can be no uniformity in the standard achieved among candidates in respect of the ancillary subjects. No further proof of this is needed than the fact that the National Certificates of the Institution of Mechanical Engineers, the Institution of Electrical Engineers, and the Institute of Chemistry, are awarded in conjunction with the Board of Education, whereas, in the case of the Certificates awarded by the Institution of Gas Engineers, the Board of Education "*are not associated in the award, though they have undertaken to endorse certificates granted under section I. of the Scheme.*" (See List 111, 1922-23, p. ix.)

The work done in the ancillary subjects by a candidate must therefore carry the status of the school at which he has taken them, and be a true guide to his abilities only when the standard of the school at which he has taken them is known.

A further point which falls under this head is the necessity for a candidate to repeat work he may already have done in the ancillary subjects, unless he has done this under the conditions specified. A large number of would-be candidates do not proceed further, simply because of this necessity.

(4) There is a tendency on all sides to blame students for the slow progress that is being made in the development of the Scheme, altogether regardless of the fact that the industry is in competition with every other for the best brains in the country, and that, therefore, while the standard required should be high, the method of achieving it should be straight-forward, and the requirements simple enough for anyone to understand. The following facts justify this point of view.

I have examined the education schemes of over twenty other professions, and it is significant that every other profession has found it necessary to institute examinations of its own in the ancillary subjects in order to ensure a proper and uniform standard of attainment in them. All of them recognize equivalent certificates of other examining bodies, *in lieu* of their own examinations in these various subjects, including "approved" courses at technical schools, in all cases where it is convenient for the students to take this line.

The nearest approach to the present Scheme that I have been able to find is that in which a course of training at a technical school is recognized in much the same way, but, in addition, a full series of examinations is instituted for the convenience of all students who find it impracticable to take advantage of these facilities.

Students who cannot attend fully approved courses, may obviously attend the minor technical schools for the early stages of the work, and be submitted by these for the examination of the Institution in the same way that they submit young men for the external examinations of the London University.

Contrast the position. In every other profession the regulations are perfectly simple and straight-forward. The candidate must take the whole of the examinations required by the profession at definite stated intervals, or, alternatively, produce their equivalent, taken with other recognized examining bodies, including, in some cases, technical schools with "approved" courses comparable with section I. of the Scheme.

If the student has already done any work in one of the subjects required, his position is clear. He must do the remainder and submit himself for examination in the whole of it.

Summarizing:

I suggest that sufficient evidence has now accumulated to show that until examinations are inaugurated by the Institution in the whole of the ancillary subjects required for both the Ordinary and the Higher Examinations, it is irrational to expect students to come forward in sufficient numbers to enable the Scheme to meet fully the requirements of the industry.

This simple extension of section II. of the Scheme would immediately place every teacher and school in the country at the service of the industry, for the training of its members in the ancillary subjects. Also, the regulations would be so simple that Advisory Boards would be unnecessary.

Finally, I wish to pay tribute to those who have worked so hard and striven so long to bring the Scheme to its present state of development. The point of view here expressed is that a further extension is necessary to simplify the Scheme and enable it to meet fully the actual requirement.

The students await the facilities.

ARTHUR COE, Principal.

The "Gas College,"
Halifax, Dec. 3, 1926.

Tar Specification.

SIR,—We have read with interest in the Dec. 1 number of the "JOURNAL" the paper entitled "Distilled Tar for Roads."

For the information of your readers, we have pleasure in informing you that our tar plant is working successfully at Beckton, producing this tar to the specification; and we are prepared, at any time, to offer small modifications to plants which have been installed by us over the last twenty years, to bring them up to the requisite standard to meet the requirements referred to in this paper.

T. D. WILTON,
Chemical Engineering and Wilton's Patent Furnace Company, Ltd.,
76, Victoria Street, S.W. 1,
Dec. 2, 1926.

REGISTER OF PATENTS.

Carburetted Water Gas Production.—Nos. 260,501 and 260,511.

FRANKFURTER GASGESELLSCHAFT, TILLMETZ, F. P., and SCHUMACHER, E., all of Frankfort-on-Main.

No. 11,202, April 28, 1926; No. 13,672, May 29, 1926.

According to the first invention, oil or tar vapour and steam are introduced as an intimate mixture into a gas producer at a comparatively high point—into a 700° to 900° C. zone. The injected mixture should be superheated; and the process may be intermittent or continuous.

The second invention is a patent of addition to the former, and more particularly deals with a double producer for the process, as is shown by the following extracts from the claims: For carrying out the method of producing carburetted water gas described and claimed in specification No. 260,501, a producer having a shaft consisting of two parts. The lower part operates as a normal generator; while the upper serves for the cracking of a mixture of steam and oil vapour introduced between the two parts, and is accordingly maintained at a lower temperature. The steam oil-vapour mixture is superheated, preferably by a pre-heating arrangement forming part of the producer. An outlet is provided at the upper end of each part of the shaft; the said outlets being provided with dampers which may be positively connected together, and by the regulation of which various temperatures may be obtained in the two parts of the shaft.

Gas Burners.—No. 260,658.

FLAVEL, P. W., of Leamington.

No. 18,970; July 25, 1925.

This invention relates to a modification of that described in specification No. 202,099 [see "JOURNAL," Vol. 163, p. 941], in which the gas burner comprises an annular discharge nozzle surrounding a central air duct cast integral therewith. It provides for the formation of the duct with a flange so that the casting can rest on a shouldered plug or like support while an annular cutter produces the discharge nozzle. The radial mixing tube is made of substantially rectangular cross-section, so as to simplify the core in casting.

Dry Meters.—No. 260,671.

SIMPSON, S., of Exmouth.

No. 19,679; Aug. 5, 1925.

In furtherance of recent inventions for dry gas meters, the patentee now seeks to reduce the overall height thereof; and the following features are incorporated.

The tangent arm is carried by the crank pin of the crank shaft by which the valves are operated; an extension of the crank shaft beyond the crank being thus avoided. The tangent arm is provided with its greater part disposed radially with respect to the axis of the crank shaft; and the pin by which the flag wire arms are connected to the tangent arm is mounted on the latter in such manner that it is adjustable radially with respect to the axis of the crank shaft. The flag wires are arranged as close as convenient to the side of the meter casing and to the outer edges of the diaphragms; the middle portions of the flag wires being cranked to ensure that they do not contact with the diaphragms.

Other features are also described and illustrated.

Clamping Rings or Meter Diaphragms.—No. 260,685.

SIMPSON, S., of Exmouth.

No. 19,875; Aug. 7, 1925.

The patentee points out that in certain gas meter designs no provision is made for permitting adjustment of the position of the diaphragm when the clamping ring is first placed in position.

According to this invention, a rim is provided attached to the centre partition of the meter, and the outer edge of the flexible diaphragm is secured to the rim by a corresponding endless ring of such form that at first it fits freely, and the diaphragm may be adjusted in position. On the ring being moved further on to the rim, the edge of the diaphragm is tightly and firmly pressed. This is accomplished by providing the endless ring near one peripheral edge of a larger diameter than near the other; the exact shape being shown by illustrations which accompany the specifications.

Removal of Tar Acids from Ammonia Liquor. No. 260,686.

ROBINSON, H. W., of Birmingham, and Parkes, D. W., of West Bromwich.

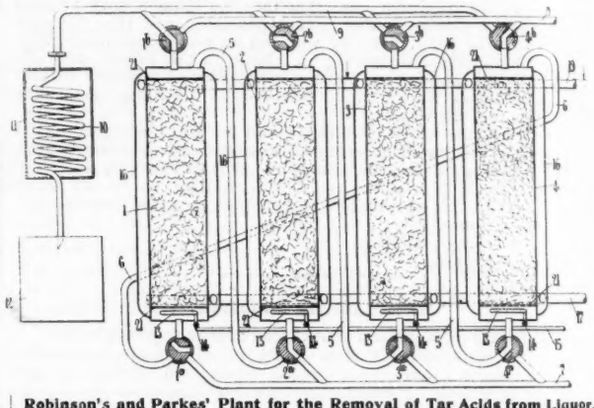
No. 19,881; Aug. 7, 1925. No. 25,288; Oct. 9, 1925. No. 8503; March 29, 1926.

This invention relates to a process and apparatus for removing and recovering tar acids from ammonia liquor or other liquors—particularly for recovering small amounts of tar acids from large quantities of liquor.

According to the invention, the liquor is acidified and subsequently brought into contact with activated carbon; it being desirable, of course, to allow any sludge present to be deposited after the acidifying treatment. The acidification may be carried out by saturating the liquor with carbon dioxide or by means of mineral acid. The tar acids are removed from the carbon by distillation, preferably by heating the carbon under reduced pressure or in a current of superheated steam, or by a combination of these. Gases such as nitrogen, carbon dicxide, and flue gases may be used instead of steam. After removing the tar acids, it is advisable to cool the carbon in a current of inert gas.

The process may be carried out either as a batch process or as a continuous process. As an example of the former, 1000 gallons of ammonia liquor containing 0·421 p.ct. of tar acids are saturated with CO_2 and allowed to stand until the precipitated solids have settled. The clear liquor is then agitated for one hour with 500 lbs. of activated carbon. The carbon is filtered off, and the tar acids removed by heating the carbon at 370° to 600° C. in a current of steam superheated to about 300° C. After removal of the tar acids the carbon is cooled in a current of CO_2, and is transferred to a fresh batch of liquor. After 18,000 gallons of liquor have been thus treated, it is found that 96·85 p.ct. of the total tar acids present have been removed from the liquor, and of the tar acids so removed 80·86 p.ct. have been recovered. If the process is continued by applying the carbon to a further 1000 gallons of liquor, it is found that the carbon will still remove over 90 p.ct. of the tar acids.

For the application of the invention as a continuous process, a plant such as is shown in diagrammatic elevation may be used. Previously acidified and settled liquor is admitted to the pipe 7, and,



Robinson's and Parkes' Plant for the Removal of Tar Acids from Liquor.

with the valves position as shown, to the bottom of the second chamber 2 of the series. Flowing upwards through this chamber, it passes through the corresponding pipe 5 into the bottom of the next chamber of the series, and so on to the last chamber. From the last chamber, the liquor flows into the outlet pipe 8. The liquor is admitted to the chambers 2, 3, and 4 at such a speed that the effluent liquor contains no tar acids; these having all been absorbed by the activated carbon contained in these chambers. During the time that the liquor is being admitted to chambers 2, 3, and 4, as shown in the drawing, the carbon which has become saturated with the tar acids in chamber 1 of the series is being heated to drive them off. For this purpose superheated steam at a temperature of 390° to 400° C. is supplied by the pipe 15 through the valve 14 to the bottom of chamber 1, while the carbon is heated by means of heat supplied to the jacket 16 to a temperature of about 400° to 600° C. During this steaming-out process, the valve 1 is in communication with the condenser coil 10, and the valve 1^a is closed completely. When all the tar acids have been removed from the carbon in chamber 1, a change-over is effected by manipulation of the various valves; simultaneous absorbing and removal of the tar acids being effected. After each steaming-out process, the chamber through which the steam has been passing is cooled before being connected up again to the other chambers of the series. Instead of steaming-out the tar acids from the carbon while the latter is in the chambers, the carbon may be removed to a separate still or retort.

As an example of the operation of such an apparatus, 61,000 gallons of liquor containing 0·421 p.ct. of tar acids may be subjected to the preliminary treatment, including acidification, as described above, and be passed through the apparatus containing 1500 lbs. of carbon at an average speed of 1890 gallons per hour. The liquor is completely freed from tar acids; and 81·8 p.ct. of the tar acids removed by the carbon are recovered.

Ordinary commercial activated carbon may contain iron compounds, and it has been found advantageous to remove such by giving the carbon a preliminary treatment with acid. The carbon is then washed with water and heated under reduced pressure and then in a current of superheated steam or inert gas; the carbon then being cooled, for example, in an atmosphere of the inert gas.

Gas Rings, &c.—No. 260,692.

SINGLETON, C. E., of Fulham.

No. 20,263; Aug. 12, 1925.

By this invention it is sought to obtain a supply of hot water as an auxiliary to ordinary heating operations with gas rings and in gas cookers. Provision is made for a water duct, tube, or tubes arranged in the proximity of the burner or burners, and so disposed parallel to and in conformity with the shape of the burner or other-

wise, that the flames from the burner impinge on the water duct; the water passing by thermosyphonic circulation along the duct, from and back to a hot-water supply tank positioned above the heating portion of the water duct, and furnished with a draw-off tap.

Various methods of applying the principle are described and illustrated in the specification.

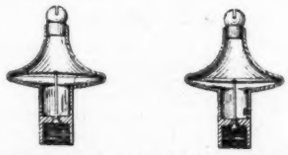
Thermostatic Controls for Gas Jets.—No. 260,846.

SPENCER THERMOSTAT COMPANY and SPENCER, J. A., both of Cambridge, Mass.

No. 8163; March 25, 1926.

This invention is applicable to flat-flame burners used in exposed places, and seeks to eliminate the danger of gas escaping if the flame is blown out. This is effected by fitting a thermostatic burner on the supply tube.

The burner is shown in section in the accompanying drawings; that on the left illustrating the cold position, that on the right the hot or open position. The claims are: 1. A thermostatically controlled device of the type having a casing provided with a fluid passageway therethrough, a valve for closing the passageway, and



An American Thermostatically Controlled Lighting Burner.

a thermostat for actuating the valve, characterized in that the thermostat is in the form of a perforated bi-metallic sheet, cupped to snap abruptly into the closed or open positions of the valve in accordance with the temperature of the casing, said sheet extending across the passageway and having its periphery seating on said casing.

2. A device according to Claim 1 further characterized in that the casing has a burner fed through said passageway and in heat-transfer relation with said sheet, and in that the sheet automatically opens and closes said valve in response to increase and decrease of temperature of the casing.

3. A device according to Claim 2 further characterized in that the burner is stationary during the operation of the device.

Gas Fires.—No. 260,721.

GLOVER, J. A. F., of Wandsworth, S.W. 18, and BURN, L., of Morden.

No. 23,090; Sept. 16, 1925.

This invention relates to gas fires of the kind in which incandescible radiant fuel columns are arranged on a reflecting base and in front of divergent lateral reflectors—particularly to fires to be located in the recesses of coal fire grates.

The patentees claim: A gas fire to be inserted in and mask the recess of a coal fire grate, having a bright metal reflecting back, fixed bright metal reflecting divergent sides, and a bright metal reflecting base bordered by the back and sides, on which stand columns of incandescible fuel over a burner pipe; with a preferably bright metal reflecting, depending skirt, the gas fire being supported in front by hollow pedestal legs, up one of which passes the burner pipe to extend transversely beneath socketed apertures in the base for the fuel columns.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 1.]

Nos. 29,407—30,100.

ANDREWS, C. W.—"Gas generators." No. 29,535.
ARDLEY, W. G.—"Means for measuring flow of fluids." No. 29,754.
CARPMAEL, W.—"Absorption of ammonia, &c., from gases." No. 29,988.
CHAPMAN, W. B.—See Andrews, C. W. No. 29,535.
COLEY, H. E.—"Low-temperature carbonization of coal." No. 29,839.
HODGSON, J. L.—"Gas meters." No. 29,770.
I. G. FARBENINDUSTRIE AKT.-GES.—See Carpmael, W. No. 29,988.
KENT, LTD., G.—See Ardley, W. G. No. 29,754.
LEWIS, G. M.—"Incandescent gas fittings." No. 29,891.
POWER GAS CORPORATION, LTD.—"Periodic operation of valves." No. 29,871.
RAYBOULD, A.—See Lewis, G. M. No. 29,891.
REYNOLDS, D. H. B.—"Apparatus for testing pipe joints." No. 29,788.
SMITHELLS, C. J.—"Purification of gases." No. 29,831.
STATTER, J. G.—"Laying pipes." No. 29,464.
SVENSKA AKTIEBOLAGET MONO.—"Remote indicating devices for automatic gas analyzing apparatus." No. 29,646.
WALDROGEL, E. MUHLETHALER-.—"Lighter for gas." No. 30,003.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Special Orders.

Bridgwater, and Torquay and Paignton Gas Orders: Referred to the Special Orders Committee.

Brighton and Hove, and Gloucester Gas Orders: Report from the Special Orders Committee that no petition had been presented against these Orders, and that there was nothing in them to which to call the attention of the House.

HOUSE OF COMMONS.

Special Orders.

Bridgwater, and Torquay and Paignton Gas Orders: Copies presented.

MISCELLANEOUS NEWS.

NEW PLANT FOR BELFAST.

Details of Reconstruction Scheme.

The Belfast Corporation have decided on the installation of additional plant to increase the manufacturing capacity of the gas-works. The Committee met specially to hear a report by the Engineer (Mr. J. D. Smith) on the carbonizing plant. He pointed out the normal and steady increase of about 5 p.ct. in the consumption, apart from increased demand arising directly out of the coal strike. To provide an entirely new carbonizing plant at present would be impracticable, as even a section could not be completed in time for the winter load next year.

The reconstruction of the existing "C" and "D" Glover-West vertical retort installations offered several advantages in comparison, including (1) lower capital cost per million cubic feet of increase, (2) the reconstruction could be carried out during the spring and summer months without interrupting the normal output, and in sufficient time to meet the winter demands of 1927-28, (3) lowest possible carbonizing costs, and (4) retention of present sites for future extension. The reconstruction of "C" and "D" benches would cover a period of two years. It was proposed that the "D" benches, comprising ten settings of 80 retorts in all, should be reconstructed during 1927, and the "C" benches, comprising the same number of retorts, during 1928. The approximate cost of reconstructing the "D" benches, comprising entirely new fire-brick and silica work in place of that existing, the necessary new retort bench equipment, and all other modifications, would be £50,000. The cost of reconstructing the "C" benches would be the same. The reconstruction introducing the latest type of the Glover-West setting would result in an increased output from the "D" benches of approximately 2 million c.ft. of gas a day, and 4 millions when the whole of the "C" and "D" benches were completed. The output of the retort house containing the "C" and "D" benches would represent an increase of approximately 70 to 80 p.ct. on the present output; and the necessary addition to the operating staff would be 50 p.ct.

In addition to the reconstruction of the "C" and "D" benches, it was recommended that Bonecourt waste-heat boilers should be added, at an approximate cost of £10,000 for each bench. Waste-heat recovery in connection with modern retort house practice had proved to be a very sound investment in the "A" and "B" retort house, where, with less modern boilers than the Bonecourt, the whole of the steam required for the benches was being produced, with a surplus for other purposes. It was estimated that Bonecourt boilers installed in the "C" and "D" benches would save fuel to the approximate value of £8000 per annum, by supplying steam for the retort benches and yielding a considerable surplus for other purposes. Apart from the saving in fuel, the present Lancashire steam boiler installation would be relieved, with a consequent saving in labour. The savings effected in fuel and labour suggested that the capital cost of the boilers would be met in two years.

Mr. West attended, and explained that the proposed reconstruction of "C" and "D" benches of vertical retorts would about double their gas manufacturing capacity. He was of opinion that in the reconstruction of the first section approximately £9000 or £10,000 would be spent on local labour.

At a later meeting, the tender of West's Gas Improvement Co., Ltd., for the reconstruction of "D" bench of vertical retorts and for two Spencer-Bonecourt waste-heat boilers was accepted. Application is being made to the Ministry of Labour for approval of the work as an unemployment relief scheme.

The Yeovil Corporation Gas Department, who recently purchased large stocks of coal, are now retailing their surplus to consumers at 3s. per cwt.

Referring to a recent discussion as to the respective merits of gas and electricity, a correspondent writes to the "Western Morning News": "Why not endeavour to get electrical engineers to instal gas engines for the generating sets of their stations? There appears to be a great opportunity for a combination of coal gas and electricity."

MEMORIAL SERVICE FOR SOUTH METROPOLITAN MEN.

Last Saturday a large congregation, including Directors and chief officers, met in the Southwark Cathedral to honour the memory of the 386 men of the South Metropolitan Gas Company who died in the service of their country during the war. The Company's Military Band occupied a place in the South Transept, and the "Metrogas" Choral Society, under the conductorship of Mr. H. W. James, were given seats in the chancel. The Cathedral bells were rung before and after the service, and memorial music was played by the Band as the congregation were assembling.

At three o'clock the cathedral choir entered, followed by Rev. F. Challenor (Vicar of St. Andrews, East Greenwich), Rev. C. R. Gorman (Vicar of Christ Church, Old Kent Road), Rev. A. W. Barker (Vicar of St. Mary Magdalene, Old Kent Road), Rev. Canon J. B. Haldane (Precentor), and the Lord Bishop of Kingston-upon-Thames (Bishop-Designate of Blackburn).

The service commenced with the anthem "I Heard a Voice from Heaven," and included Psalms XV. and XXIII., a lesson (1 Thes., Chap. IV., verses 13-18) read by the Rev. F. Challenor, the canticle Benedictus, and prayers by the Precentor. In addition there were hymns, accompanied by the Band, and two anthems by the Choral Society.

The Bishop of Kingston was the preacher. After the sermon, a prayer was said from the burial office; and the kneeling congregation sang the metrical version of the Contakion for the Departed ("Give to Thy servants rest, O Christ"), and the Bishop gave the Blessing. The Last Post was sounded from the west end of the nave, and the Réveillé from the triforium of the tower, after which two verses of Kipling's "Recessional," followed by the National Anthem, brought the service to a close. Many of the congregation passed through the Lady Chapel, and placed flowers in front of the Memorial Window.

LUCKY NEWCASTLE.

No Coal Stoppage Increase in Price of Gas—The Company's Policy.

The Newcastle City Council—the Lord Mayor (Councillor Arthur W. Lambert) presiding—on Dec. 1 received with great satisfaction a letter from Mr. T. P. Ridley, the Secretary and Commercial Manager of the Newcastle and Gateshead Gas Company, intimating that the Directors had decided not to increase the price of gas.

Sir George Lunn, Chairman of the Coal Emergency Committee, presenting the final report of the Committee's activities, declared that the Gas Company had "played the game" during the coal crisis. The letter was in the following terms:

> Your Council will no doubt be anxious to know the intentions of this Company with regard to the price to be charged for gas as a result of the mining dispute.
>
> The Directors, having in mind that both prior to and also during the dispute trade depression in this district was probably more acute than in any other in the country, took the exceptional course of refraining from making any increase in the price of gas during the dispute, when other fuels were necessarily greatly increased in price.
>
> The cost of coals, even after allowing for enhanced prices obtained for residuals, has been very serious indeed; and the Company would be fully justified in increasing the price of gas to cover this cost, and in applying to the Board of Trade for a temporary increase in their standard price.
>
> In the belief, however, that within a few months the cost of coal will not be greater than that ruling in the early part of the year, and that receipts from residuals will be more than proportionate to the cost of coal, the Directors, after considering the estimates for next year, have decided to face the situation without increasing the price of gas. They propose to carry a portion of the loss to a suspense account to be liquidated next year out of the enhanced price of residuals, and to meet the balance out of the Company's reserve funds, which they hope to rehabilitate over a period of years.
>
> The Directors realize that they are taking certain risks in adopting this policy, but think it is in the interests of both the consumers and the Company to take such risks, as by doing so they will be assisting the early development of the prospective improvement of trade in the district.
>
> The Directors feel sure that the City Council will appreciate that it has only been possible at great cost, and often with great anxiety, to maintain the quality, pressure, and price of gas unaltered during the period of the dispute, and they trust that consumers will support them in their present policy by making full use of their gas appliances, which is the best possible way of assisting the Company to maintain the low price of gas now ruling.

GAS COMPANY'S COKE.

Regarding the Newcastle Gas Company, Sir George Lunn told his colleagues something of the history of the Company's help to the Coal Emergency Committee. The Gas Company at the commencement of the coal stoppage had 120,000 tons of coke in stock. The Committee had had to issue placards urging householders to use coke in conjunction with coal. Some of the coke was sent to other parts of the country, and some of it was exported; and to the credit of the Company, during the first four and a half months of the stoppage there was no advance in the price of the coke. So long as stocks held out, so long did the Company charge pre-stoppage prices. It was only when coal had to be imported, first from the Continent and then from across the Atlantic, that the price had to be increased. The freight cost of the coals brought across the Atlantic was more than twice the pre-stoppage price of coal. Emphatically in his opinion the Newcastle Gas Company had played the game by the public.

PUBLIC-SPIRITED ACTION.

This is what the "Newcastle Daily Journal" for Dec. 2 had to say about the Gas Company's action:

> The Newcastle and Gateshead Gas Company Directors are to be cordially congratulated on their public-spirited decision to "take certain risks" and not increase the price of gas. It is a decision one would expect naturally from such a far-seeing, enterprising Board of Directors composed of men in close and sympathetic touch with the area of supply. They realize, as they state in their letter to the local Councils, that their action may assist the early development of trade recovery, and such recovery will ultimately be to the very material benefit of the Company in every department of its activities. Certain Labour members of the Gateshead Council received the Company's intimation with cheap jibes and dark suggestions regarding alleged profits on coke; but the general public will accept Sir George Lunn's assurance that the Gas Company has "played the game" during the coal stoppage. Sir George Lunn is a shrewd businessman who does not shower his blessings upon anyone or anything unless he is quite satisfied they are deserved.

WANDSWORTH TECHNICAL INSTITUTE.

Gas Equipment.

Gas has largely contributed to making the Wandsworth Technical Institute, which has recently been erected, modern and efficient in every respect. In one of the laboratories (and there are several) can be seen a gas-fired boiler capable of raising 900 lbs. of steam per hour, and which from cold can be at full working pressure within 30 minutes. The gas supply is automatically controlled by a regulator that can be set to keep the steam at any predetermined pressure. In the same laboratory may be seen a 12-15 H.P. modern gas engine used for generating power, and so fitted that various experiments may be carried out to determine many factors requisite and necessary to the instruction of the student of engineering. In the machine laboratory is a different type of gas-fired boiler, capable of raising 140 to 150 lbs. of steam per hour; the working pressure of 120 lbs. per sq.in. being obtained within 40 minutes of starting from cold.

Gas is used extensively in the laundry centre for ironing; a row of gas ironing stoves occupying nearly one side of the room. There are a special apparatus for drying clothes by gas, and a gas heating stove. In the "cookery" section is a row of modern gas cooking stoves on one side of the instruction room. For the ideal cooking of vegetables, gas-heated steam ovens are installed.

Throughout the building, in the various laboratories and lecture rooms, upwards of 100 bunsen burners are employed for the use of the lecturers and the students. The burners for the students are, in the different laboratories, most ingeniously disposed; the series of work-benches being provided at intervals with "wells," in which are fitted the gas connections, and in which the bunsen burners themselves are housed when not in use. Each "well" is covered by a removable lid, flush with the bench, leaving an unbroken bench surface when for any purpose such may be required.

In the sheet-metal shop, a number of gas-heated soldering-irons are in use; the plumbing shop is equipped with gas-fired lead melting pots; while in the carpenters' shop, gas is employed for warming glue.

And last, but by no means least, the creature comforts and welfare of the students are specially looked after; a well-appointed kitchen forming part of the general scheme. Here dinners are cooked ready for the mid-day "break," by means of gas cookers, or kept warm in a large gas-heated warming oven.

In regard to the social side of the activities of the Institute, an "all gas" kitchen proves an inestimable boon, providing as it does all the facilities for quick and thoroughly efficient service on the occasions when the students have their social gatherings. Indeed, it would be an easy matter with the apparatus installed and available in the building to cook a banquet for a large assembly. It is not undue praise to say that the gas installation is a striking example of the many spheres in which gas provides such an excellent service, and with a certainty and economy second to none.

CONTRACTS OPEN.

Coal.

Tenders are invited by the Birstall Urban District Council for the supply of gas coal. [See advert. on p. 653.]

Meters.

The Gas Committee of the City of Leeds are inviting tenders for the supply of ordinary and prepayment dry meters. [See advert. on p. 653.]

Heating at Alnwick Castle.—Three of Wright's "St. David" gas radiators have been installed in Alnwick Castle, the seat of the Duke of Northumberland. These radiators will be used to warm his Grace's private library; and it is interesting to note that gas is chosen where efficiency combined with absolute safety in all circumstances is such a prime necessity.

Belfast and the Coal Trouble.—A recent meeting of the Belfast Corporation Gas Committee was largely devoted to a well-deserved eulogy of the Engineer and Manager, Mr. J. D. Smith, for the manner in which he had coped with the serious situation arising out of the coal dispute. It was moved by Councillor Harcourt, seconded by Councillor Stewart, and unanimously resolved, that the Committee record upon the minutes their high appreciation of the services rendered by Mr. Smith during the trying period which had been experienced recently in the Gas Department, in consequence of the trouble in the coal industry.

LONG SERVICE.

On Tuesday, Nov. 30, forty-six employees of Messrs. West's Gas Improvement Company, Ltd., of Miles Platting, Manchester, were presented by Alderman F. J. West, the Chairman of the Company, with long service certificates in the form of a framed illuminated address designed by Mr. Alan Tabor, the well-known Manchester artist. The four employees, each with a length of service of over forty years, were also presented with gold watches. The presentation was made after a dinner at which the Directors entertained the recipients and their wives.

The Chairman was supported by the whole of the Directors of the Company; Messrs. J. H. Bainton, S. Glover, W. A. Valon, Frank West, and Ernest West.

The following are the names of the recipients with over forty years' service.

48 years	:	Mr. R. J. H. Sayers (London Office).
43	,,	Mr. H. Allchin.
42	,,	Mr. H. H. Thompson.
41	,,	Mr. A. E. Kirby (retired).

Among others with thirty years' service are Mr. W. Wild and Mr. F. E. Bird (Australian Office), and among those with from 25 to 30 years' service Messrs. H. Clegg, J. W. Curtis, J. V. Barlow (Secretary), and T. A. Tomlinson (Engineer).

The CHAIRMAN mentioned the fact that the average length of service rendered by these members of the official and the works staff amounted to over thirty years. He did not remember an occasion in the previous history of the Company when the Directors had had the opportunity of meeting such a representative gathering of the staff and workpeople. Three years ago they had met to celebrate the Jubilee of the Company. That evening they had assembled to do honour to those who had for at least 25 years, and in many cases for much longer periods, rendered faithful and efficient service in the development of a business which, to-day, was one of the most important in the gas industry. Three of the recipients were among those who took part in the small beginnings of their Company at Maidstone between forty and fifty years ago, and a number took part in the early activities of the Company at the Albion Iron-Works, Miles Platting, forty years ago.

It was not necessary to remind them that it was primarily due to the indomitable pluck, the ceaseless energy, and the glorious optimism of the founder of the Company, the late Mr. John West, that West's Gas Improvement Company had emerged successfully from the difficulties of the pioneer work of the early days; and the particular men to whom he had referred must be congratulated upon their association with the founder in the work of those strenuous times.

In 1906 the Company turned from the manufacture of stoking machinery to the development of the Glover-West vertical retort. The success of that policy was measured in the rapid and world-wide adoption of the system, which was now represented by installations spread over many of the principal gas undertakings both in this country and in all the five continents.

Ald. West said it might be asked what was the value of the long service certificate. He would reply that, first of all it was a tangible expression of the appreciation of the Directors of the Company of long and efficient service, and that they should reflect that such length of service necessarily implied loyalty, good conduct, and satisfactory and efficient workmanship on the part of the recipients, and, finally, that anyone who had rendered this service must at any rate be satisfied with the conditions of his employment. The fact that there were so many who were qualified to receive these certificates was proof that the firm aimed at treating their employees as no mere hands to be lightly discharged and taken on as trade ebbed and flowed, but that there was a real consideration of the human element in their industrial relationship, and an endeavour to cultivate goodwill. The presentation of long service certificates was to be an annual event; and he hoped that very many of the younger officials and workpeople present would in turn qualify for them.

GAS REGULATION ACT APPLICATIONS.

SPECIAL ORDERS.

Earl Shilton Gas Light and Coke Company, Ltd.

To authorize the Company to supply gas in a specified district on the thermal basis; to empower them to use scheduled land for gas purposes; and to bestow upon them other powers.

Newquay (Cornwall) Gas Company, Ltd.

To authorize the Company to use scheduled land for gas purposes, to make provision as to the charges which they may demand in respect of gas supplied through prepayment meters, and for other purposes.

AMENDING ORDERS.

Commercial Gas Company.

To substitute for the standard price of 12d. per therm a standard price of 12·6d. per therm, until Dec. 31, 1927.

Loughborough Corporation.

To substitute for the existing maximum prices of 13d. and 14·2d. per therm, maximum prices of 16d. and 17·2d. per therm respectively until Dec. 31, 1928.

DECLARATIONS OF CALORIFIC VALUE.

Burnley Corporation.—450 B.Th.U., in substitution for 475 B.Th.U. (March 1, 1927.).

Nelson Corporation.—425 B.Th.U. (March 1, 1927.)

CO-PARTNERSHIP AT REDHILL.

The annual meeting of the Redhill Gas Company's Co-Partnership Scheme was held on Thursday, Nov. 25. The Chairman, Mr. G. R. Hunt, J.P., in moving that the Committee's report and the statement of accounts for the twelve months ended June 30 be adopted, said that they were reporting a present membership of 137, as against only 74 in 1921. The rate of bonus was 5½, against 2 p.ct. in 1921, and the total amount of bonus and interest credited last year was £1182, compared with £279 five years ago. At the annual meeting in 1921, the savings deposits by co-partners were reported as £11, whereas last year they reached £594. While the amount invested in the Company's capital stock through co-partnership during 1921 was £74, the sum so invested during the past year was no less than £1424. In addition to the £6750 capital stock in the Company registered under the scheme, the nominal amount of £2215 of stock was held by a certain number of co-partners independently. Thus the amount of capital registered in the names of the co-partners, all told, made the respectable total of £8965, divided between 129 members, and giving an average of nearly £70 per head.

Negotiations are proceeding between the Accrington Gas Board and the Altham Colliery Company regarding the possibility of that Company conveying to the Board's gas-works a supply of gas from a large installation of coke ovens proposed to be erected at their Moorfield Colliery.

GAS WORKERS AND CONTRIBUTORY PENSIONS.

Considerable discussion, affecting general principles as to a contributory pensions scheme for gas workers, has arisen in Nottingham, where the Gas Committee have prepared a report for consideration by the Council, in which the view is expressed that the existing system is unsound in principle and uneconomical in practice. One of the grounds upon which this deduction is based is that at present there is no uniformity throughout the various departments of the Corporation, either as to the age at which a retiring allowance should be granted or as to the scale or method upon which the amount of the allowance is to be ascertained.

Attention is directed by the Committee to the circumstance that dissatisfaction is frequently caused among workmen of the same class, owing to the fact that distinctions are now drawn between them, either on account of length of service or other special considerations, in determining the rate of allowance and the age at which such allowance shall become payable. The Committee point out that workmen employed in certain sections of the Gas Department are often reduced in efficiency by reason of the presence among them of aged men whose service has naturally become impaired. No contribution is at present payable by the Nottingham workmen themselves towards the allowances which may be subsequently granted to them. The Committee employ on the average 687 workmen; and in this number there are approximately 60 who have already attained the age of 65 and over. The representatives of the National Union of General and Municipal Workers have frequently pressed for the adoption of a fixed scale of allowances based on length of service, and a minimum allowance considerably in excess of that paid at the present time; and the matter has been discussed by them on many occasions.

The Committee are of the unanimous opinion that the time has arrived for applying to the Board of Trade to authorize the establishment by the Council of a contributory retiring allowance scheme for manual workers in the Gas Department who attain the age of 70 years, or who become incapacitated before that age.

PORTSMOUTH GAS SUPPLY DURING THE COAL STRIKE.

The "Evening News & Southern Daily Mail" for Dec. 3 publishes an article on how the Portsmouth Gas Company overcame the difficulties caused by the coal stoppage, and maintained a normal supply of gas. In Portsmouth, it is stated, there has, fortunately, been no material reduction in either the supply or the quality of the gas, and the pressure has throughout been maintained above the statutory minimum. This state of affairs is largely due to foresight, upon which the Directors of the Portsmouth Gas Company, and Mr. T. Carmichael, their Engineer, are to be congratulated.

AN UNINTERRUPTED SUPPLY.

In view of the experiences of 1921, abnormally large stocks of coal have since been carried at the Portsmouth Gas-Works. In other words, for the past five years the capital represented by some 25,000 tons of coal has been lying idle—or worse than idle, for the coal deteriorates in storage—and the Directors have wisely sustained this loss in order to ensure the continuance of the gas supply during such a period as we have recently passed through. In return they have had the satisfaction of an uninterrupted supply.

In addition, a much larger quantity of gas has been consumed than is usual at this season of the year; the increase over the corresponding days of 1925 varying up to 20 p.ct. A circular letter issued to each consumer on Oct. 22 pointed out the urgent need for economy in the use of gas, but this had little or no effect on the quantities sent out from the various works of the Company.

At first sight it would appear that herein is the Company's return for the idle coal stocks; but such is unfortunately not the case. The price of gas has been raised by ½d. per therm (6¼ p.ct.) since Sept. 30, it is true; but even with this increase the Company have been selling gas at less than cost price for some months.

IMPORTED COAL.

The reason is obvious. The stock of coal above referred to, though large in itself, is sufficient to supply Portsmouth with gas for a very short time only, and in consequence it has been necessary to purchase large quantities of foreign coal at prices ranging from 100 to 250 p.ct. higher than contracts which were cancelled by the strike. This was not the only drawback, for while a few cargoes of the imported fuel have been of fair quality, the majority were far inferior to English coal. One consignment contained only 17 p.ct. (instead of the usual 30 p.ct.) of volatile matter; and in most cases the yield of coke was very small.

Freights and transport have added to the difficulty and the cost of manufacturing Portsmouth gas. During the first months of the strike, for instance, a fleet of steam wagons was engaged daily in transporting stock coal from Hilsea to Flathouse. Later the position was reversed, and the same wagons were employed for a long period in carting seaborne foreign coal from Flathouse to Hilsea.

SHORTAGE OF COKE.

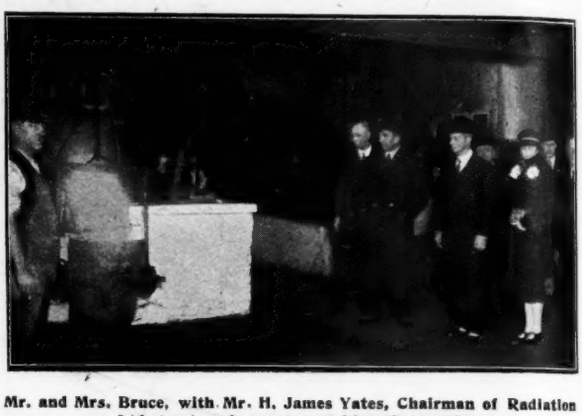
The poor yield of coke, coupled with the Board of Trade's Order to manufacture the maximum quantity of water gas, created a shortage of coke in the city; and it was early found necessary to limit the sale of this fuel to bakers, hospitals, and similar essential services. It has, however, been the aim of the management throughout to continue the sale of coke in small quantities at the works for household consumption, and this has so far been maintained. The position was also eased from time to time by importing coke—again at high prices—from other districts and from abroad. The usefulness of these small sales is seen from the fact that in one day no fewer than 1100 half-hundredweights of coke were sold at the Flathouse Gas-Works alone.

The stoppage has witnessed a time of great activity in the fittings department, particularly in regard to the supply and fixing of gas fires, cookers, geysers, and other appliances. It may be, therefore, that one of the few beneficial results of the coal strike will be a reduced consumption of raw coal in the domestic grates of the city. This will constitute another step towards a purer atmosphere and the abatement of smoke.

AUSTRALIAN PREMIER INSPECTS FOUNDRY.

Mr. Bruce's Visit to Gas Appliance Works at Birmingham—Inter-Empire Trade.

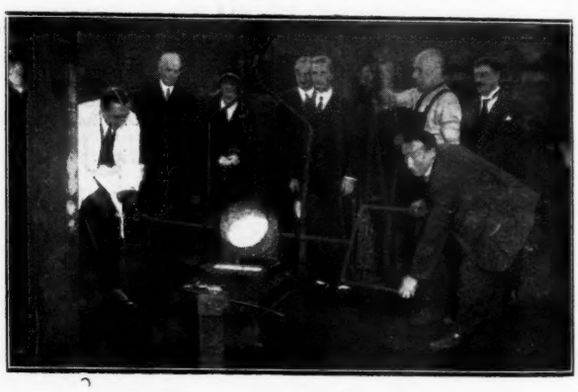
Mr. Stanley Bruce, the Australian Premier, and Mrs. Bruce had a novel experience when they were conducted over the works of Messrs.



Mr. and Mrs. Bruce, with Mr. H. James Yates, Chairman of Radiation Ltd. (centre of group), watching the cupola.

John Wright & Co.—a constituent firm of the Radiation group of gas appliance makers—at Aston, Birmingham, on Nov. 30.

In welcoming the Prime Minister, Mr. H. James Yates (Chairman of Radiation, Ltd.), said that it was peculiarly appropriate that the visit should be made at a time when the development of Empire



The Premier assists in Casting a Gas Grate.

trade was being so vigorously encouraged in Great Britain. The exchange of the world's best cookers from this country with the choicest of dried fruits and other ingredients of the Christmas pudding from the Commonwealth, offered a fine example of inter-Imperial trading. The gas appliance industry, which was one of the

The Premier casting a Paper Weight which was presented to him on leaving the Factory.

largest, and most vital to our domestic life and industrial prosperity, had made immense progress during recent years, particularly in respect of such modern comforts as gas heating and gas cooking, and,

so far as the Radiation group was concerned, had firmly established itself, not only in this country, but overseas, including Australia.

"It is a matter of pride to us," said Mr. Yates, "that both there and elsewhere in the British Dominions we are emphatically an Empire trading concern. Our order books might well be labelled 'on account of trade within the Empire;' and in this connection I should like to say how greatly we appreciate the preference that your country gives to goods made in the Home Country, in comparison with the goods of other countries.

"Radiation, Ltd, possesses through its constituent Companies as many as sixteen works, covering altogether over 100 acres, and employing over 10,000 workpeople; and we are having to make further extensions to our works, for which purpose we have recently acquired an additional 60 acres of land. Out of their sixteen works, the factory to which we welcome you this afternoon is one of six belonging to John Wright & Eagle Range, Ltd.—all situated within a radius of half-a-mile from where we now stand.

"Two aspects of the beneficial value of our work I might refer to in a sentence. In these modern days, it is appreciated that unnecessary labour is waste of energy, and gas apparatus is recognized as a great labour-saving agency in domestic life. The other beneficial effect is the important bearing of our apparatus upon the smoke problem. The modern movement—I might almost call it a rebellion—against the conditions that maintain a pall of smoke over our great cities and towns is gaining increased strength year by year."

Mr. Bruce, in a brief reply, heartily reciprocated Mr. Yates's expression of goodwill in regard to the development of inter-Empire trade, and declared that Australia was very desirous of encouraging British manufacturers in preference to the manufacturers of foreign countries.

The Premier showed the keenest interest in the various processes. Having first cast an inscribed paper weight as a souvenir, he then proceeded, with the aid of a workman, to pour molten metal from a heavy, two-handled ladle, and cast a gas grate. Both feats were heartily cheered by the workmen. The castings were then presented to him by Mr. Yates; and when completed in an art-metal finish, the gas grate will be dispatched overseas to adorn the Premier's Australian home. Mr. Bruce also saw in process of manufacture and packing large quantities of gas fires and cookers intended for the overseas market.

Eleven imitation "pennies," cut from cardboard, waxcloth, and matchbox covers, were recently found in a prepayment meter belonging to the Glasgow Corporation Gas Department, at the house of a young married woman named Margaret Henry, of Port Dundas. Accused, who was charged at the Northern Police Court with the theft of 1530 c.ft. of gas, valued at 6s. 3d., showed the Court a receipt from the Gas Department for the gas she had stolen, but afterwards paid for. She was fined 5s., or five days' imprisonment.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 6.

There is little fresh to report in the London tar products market. Business generally is quiet.

Pitch is rather nominal at 195s. to 200s. per ton; but there is very little material available.

Creosote also is scarce, and the price is firm at 9d. per gallon in bulk f.o.b.

Tar spirits generally continue strong at the prices last reported.

Tar Products in the Provinces.

Dec. 6.

The average value of gas-works products during the week were: Gas-works tar, 109s. 9d. to 114s. 9d. Pitch, East Coast, 175s. to 179s. 6d. f.o.b. West Coast—Manchester, 169s. 6d. to 170s.; Liverpool, 170s. to 172s. 6d.; Clyde, 173s. 6d. to 175s. 6d. Benzole 90 p.ct., North, 1s. 11d. to 2s.; crude, 65 p.ct. at 120° C., 1s. 4d. to 1s. 5d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 11d. to 2s. Toluole, naked, North, 1s. 11d. to 2s. nominal. Coal-tar crude naphtha, in bulk, 9d. to 9½d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha, North, 1s. 1d. to 1s. 2d. Creosote, in bulk, North, liquid, 8½d. to 9d.; salty, 8d. to 8½d.; Scotland, 7⅞d. to 8¼d. Heavy oils, in bulk, North, 7½d. to 7⅞d. Carbolic acid, 60 p.ct., 1s. 9d. to 1s. 10d. prompt. Naphthalene, £11 to £14; salts, 90s. to 100s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

British Industries Fair.—It has been officially announced in London that the whole of the space in the British Industries Fair, which is to be held simultaneously in London and Birmingham from Feb. 21 to March 4 next, has been taken, with the exception of a few spaces rendered vacant in the Birmingham section by extensions of the Castle Bromwich premises. No more applications for space in the London section at White City, Shepherd's Bush, can be considered. Space has been snapped up at the rate of 1200 sq.ft. a day lately; and the amount asked for is well in excess of what is available. In the Birmingham section, which is being organized by the Birmingham Chamber of Commerce for the hardware, building, engineering, electrical, and other "heavy" industries, booking of space has exceeded by 25,000 sq.ft. the total available in the 1926 display, which itself beat all previous records. At Castle Bromwich, however, big permanent extensions have been carried out: and as a result of adjustments thus made possible, a few good spaces have been rendered vacant, and there are also a limited number of small stands at nominal cost.

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NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

Restarting, after so long a period of idleness, is proving a slow business in most instances, and many difficulties are being encountered in the pits. It is not anticipated that anything like full output will be reached this year.

At the same time, there is enough coal to cause much anxiety in many cases to collieries in view of the Government restrictions. Considering what a small proportion of the output of Northumberland and Durham is normally consumed at home, it is easily understood how difficult it is to find a home market for large quantities suddenly, even after seven months' idleness. There appears to be no terrific demand at home, such as to absorb readily the increasing output, and the delays and difficulties in obtaining export licences, which seem inseparable from official interference with business, have caused anxiety to many collieries. The threat of idle time is a very real one. It is true that prices are lower than had been anticipated, because consumers have practically been able to call the tune. But the situation now calls for a free market and stabilization, so that sellers and buyers alike can get on with the serious business of arranging their affairs ahead.

Conditions at the moment are chaotic, and of the hand-to-mouth order. Collieries have been quoting 25s. to 27s. 6d. f.o.b. for prompt lots of gas, but most transactions seem to have passed on a basis of 20s. to 22s. 6d. Firm quotations, in the present circumstances, are difficult to obtain for forward business, and it is impossible to see how the market will shape. Fitters' ideas in many cases are round 20s. for next year, though some will not include the first three months in this, either being fully sold, or wanting a higher price for that period.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From our Local Correspondent.

With the majority of the Yorkshire and Lancashire collieries in fairly good working order, there has been a much more rapid resumption of work than was anticipated at the time the district settlements were arrived at.

With the increasing outputs the local markets will soon be free from anxiety in regard to supplies. These conditions have tended to bring about considerable reductions in market prices for all descriptions of coal. It will, of course, be some time before prices become stabilized, even so far as any particular area is concerned, but should the present state of things continue, there will no doubt be coal for export from Yorkshire within the next few weeks.

Gas concerns report that already they are receiving limited supplies of their contract fuels, and prices for outside qualities that have to be bought are at discounted figures. There is still some American gas coal to arrive, but the total tonnage is a doubtful quantity.

COAL TRADE IN THE MIDLANDS.

From Our Local Correspondent.

Market deflation has proceeded somewhat erratically. With demand rigorously repressed, both in the domestic and industrial branches, the distributive channels have been congested. Short time working at the pits is reported to have resulted in exceptional cases from lack of trucks to take away the output. There has been an attempt to control the subsidence of prices by concerted action in the different coalfields. Only partial success has attended it, however. In Warwickshire two cuts of 5s. each were made in best house coal within the space of a few days.

While the readjustment of prices by distributors was gradual, and achieved without very much confusion, competition for the industrial trade led to greater irregularities. There is little prospect of the heavy industries in this area getting under way before the New Year. Meanwhile, dependent branches are awaiting developments. Those manufacturers who were producing became more strict than ever in the limitation of their purchases of coal to immediate necessities, and so assisted to accentuate the excess of production (*plus* importations) over current consumption.

There was a break of 20s. or even more in the case of some classes of works fuel, particularly slacks and smalls. Within a week of the removal of control, slacks could be bought at 25s. upwards. Yearly contracts were offered at April rates, and six months contracts at little more; but there was no eagerness on the part of consumers.

The annual social and dance of the New Grange Bowling and Golf Clubs, organized by the employees of Messrs. Alder & Mackay, Ltd., Edinburgh, was held in the Assembly Rooms, George Street, on Friday night, Nov. 26, when there was a company of approximately 400 present. The Chairman of the Company (Mr. James Miller Thomson, W.S.) presided at the distribution of prizes, which were presented by Mrs. Stanley Bennet. In the course of his remarks, the Chairman made mention of the Clubs' excellent record since their inauguration 25 years ago, several open trophies having been again secured by the Bowling and the Golf Clubs. These, as previously, were entrusted to the safe keeping of Mr. J. L. Bennet for display in the firm's board room. The Rt. Hon. Alexander Stevenson, Lord Provost, who has for many years represented Gorgie Ward in the City of Edinburgh, honoured the company with his presence, and was given a very cordial reception. He personally handed to the winner of the golf Medal competition a gold medal presented by himself, and observed that the recipient was the first person in Edinburgh to receive a medal bearing his name as Lord Provost. He commended Messrs. Alder & Mackay on the excellent relationship existing between the Directors and the employees, which he felt sure was largely brought about by this annual social gathering.

Dasnieres, Ltd., of 21, Water Lane, E.C., have been registered as a private Company, to carry on business as pitch and tar merchants, &c. The nominal capital is £16,000 in £1 shares.

Belfast Gas Finances.—Reporting upon the financial position of the Belfast Gas-Works, the Manager (Mr. J. D. Smith) said that the extra cost of coal and oil would be approximately £76,000, and the loss from the sale of coke and chemicals £10,000 (total £86,000). The increase in the price of gas from Oct. 1 would reduce this amount considerably; but it was quite clear that at March 31 next they would close with a deficit of about £15,000. Taking everything into consideration, he was of opinion that the price of gas should not be further increased, but that any loss should be carried forward to the following year. His Committee have endorsed this view.

Granton Gas-Works.—In the "Edinburgh Evening News" for Nov. 27 there appeared an interesting popular article in connection with the Granton Gas-Works and the new plant there. The writer of the article mentions that the output of gas last year was 2,947,596,000 c.ft.—an increase of 131 p.ct. on 1890. In five years the output has grown 40 p.ct. The Gas Committee have 114,000 customers, and gas is distributed over an area of 50 sq. miles. There are 483 miles of mains, and over 1500 miles of service pipes. There are 82,000 gas appliances on loan and hire-purchase. With allowance made for consumers' own property, it is computed by the Committee that there must be a gas appliance in nearly every home.

Good Results at Stockport.—On the whole, states Mr. S. Meunier, Engineer and Manager to the County Borough of Stockport Gas Department, in his report for the year ended March 31, the working of the Department during 1925-26 can be considered satisfactory. There was an increase in gas sold of 7·85 p.ct., but the diminished revenue from residuals, and the further reduction in the price of gas by 3d. per 1000 c.ft. from the September quarter of 1925, which reduction would affect about two-thirds of the total consumption for the year, more than counterbalanced this. That they were in a position so to reduce the price, he maintains, is proof of the efficient working of the new carbonizing plant and the supplementary additions to it—all tending to more economic working. The revenue from gas was increased by £2500, due to the greater demand during the year; increase in make being 98 million c.ft. The total annual output now amounts to over 1000 millions. The net profit for the year was £2652.

Fatal Accident at the Walsall Gas-Works.—A verdict of "Accidental death" was returned at an inquest at Walsall on Frederick Llewellyn Lakin, a labourer employed at the Corporation gas-works. Benjamin Thickett, another labourer, stated that on Saturday morning, Nov. 13, he went to the retort house to fetch a wheelbarrow, and saw Lakin fixed in the shafting of a coke-screening machine, on which they were employed. He stopped the motor, and on reaching Lakin found he was dead. Practically all his clothing had been torn off. Lakin had evidently gone to oil machinery while in action. Mr. Fred. Davis, the Gas Engineer, told the Coroner that the instruction to all men engaged with machinery was that there must be no oiling or greasing when it was in motion. Mr. P. A. Heath (Inspector of Factories): Was it within your knowledge that it was done, as we know it was? Witness: No, it has come as a surprise to me. Further questioned, Mr. Davis said that Lakin was engaged on day work, and there was no reason why he should not have stopped the machinery in order to inspect or oil it.

Britain's Biggest Company.—The registration of Imperial Chemical Industries, Ltd., was formally completed on Saturday, Dec. 4. The Company has been registered with an authorized capital of £65,000,000. As has already been announced, if all the shareholders of the merging companies exchange their shares for shares in the new company, the issued capital will be £56,802,996. Among the objects of the Company are acquiring or holding shares in Brunner Mond & Co., Ltd., Nobel Industries, Ltd., the United Alkali Company, Ltd., and the British Dyestuffs Corporation, Ltd. The first Directors of the Company will be: The Right Hon. Sir Alfred Mond, Bart., M.P. (Chairman), Sir Harry McGowan, K.B.E. (President and Deputy Chairman), the Right Hon. the Lord Ashfield, P.C., Sir John Brunner, Bart., Mr. G. C. Clayton, C.B.E., M.P., Mr. H. J. Mitchell, Mr. Henry Mond, Sir Max Muspratt, Bart., Mr. J. G. Nicholson, Lieut.-Col. G. P. Pollitt, D.S.O., the Most Hon. the Marquess of Reading, P.C., G.C.B., G.C.S.I., G.C.I.E., G.C.V.O., Sir Josiah Stamp, G.B.E., and Mr. B. E. Todhunter. The Company has the biggest initial capital of any registered in this country.

The Lytham St. Annes Gas Manager reports that during October increases of 42 p.ct. over the corresponding month of last year were recorded. Over 200 gas fires were fixed.

Messrs. C. & W. Walker, Ltd., have moved their London office from Cannon Street to 70, Victoria Street, Westminster, S.W. Telegrams: "Fortress Sowest, London." Telephone: No. 1941 Victoria.

It was hinted at a meeting of the Accrington and District Gas Board on Nov. 25 that there might be a further advance in gas charges. The Manager (Mr. A. J. Harrison) said that the Board's commitments for the purchase of coal from May 31 to end of December were estimated at £62,000, against a normal amount of £22,000. It was obvious that an 8½ p.ct. increase in the price of gas was inadequate to cover the loss.

At an inquest at Peterborough on Nov. 29, on Mrs. Mary Peach, a widow, who was found dead in her house following an escape of gas fumes from a fractured gas main under the roadway, a verdict of accidental death was returned, and the Gas Company was exonerated from blame. Evidence was given that customers in an inn opposite the house experienced a choking sensation, and were driven outside to recover, and two men fell unconscious. Representatives of the Gas Company stated that every precaution was taken, and the roadway tested; but the leakage, occurring at night, made immediate repair impossible.

STOCK MARKET REPORT.

ALTHOUGH the coal dispute had ceased to be a direct factor in the markets, Stock Exchange transactions were irregular and uncertain last week. The condition of affairs in China was a depressing influence, as was also the further improvement in the value of the franc which resulted in heavy selling from Paris. Rubber is causing anxiety. The commodity fell to 1s. 6d. per lb. for the first time since February, 1925, and there are suggestions of a Rubber Producers' pool. Meanwhile, the good prices obtained since that date continue to be reflected in the high dividend distributions by the majority of the companies. More acquisitions by the Drapery Trust are announced, and issues are to be made to the public in respect of geographical groups of the undertakings. The first issue is expected to be the Scottish group, for which 200,000 ordinary shares are to be offered at 23s. per share.

In the Gas Market there were a few more changes in the quotations than have occurred latterly. Of the companies operating at home, Cardiff were marked up 2 points, Gas Light 1 point, and South Metropolitan ½ point. On the other hand, Liverpool dropped ½ point, and East Hull fell 5½ points. The latter is not remarkable, as the price was previously unduly high.

From the gas investors' point of view, it is satisfactory to learn that Durham coal is at last being offered in London on pre-stoppage contracts. Cargoes are expected to arrive during the current week.

The following transactions were recorded during the week:

On Monday, Bournemouth 5 p.ct. 12⅝, 12¾, Commercial 3½ p.ct. 75, European 6¾, Gas Light and Coke 84, 84½, 84⅜, 85, 85½, 4 p.ct. preference 76, Montevideo 80½, Primitiva 13s. 3d., 13s. 4⅛d., 13s. 6d., 4 p.ct. debenture (1911) 70½, 71, South Metropolitan 92, 92⅜. Supplementary prices, Bournemouth "New" 6 p.ct. preference (£2 paid) 45s., Eastbourne 3½ p.ct. "B" 103, 103½, Walton-on-Thames 10 p.ct. maximum "A" 13⅜, 13⅝.

On Tuesday, Alliance 83, 83½, British 105½, 4 p.ct. debenture 70, Gas Light and Coke 84⅜, 85, 85⅛, 85⅜, 3½ p.ct. 59¼, 4 p.ct. preference 76, 3 p.ct. debenture 58½, 59, 59¼, Imperial Continental 130, 131, Liverpool 7 p.ct. preference 101, Primitiva 13s. 3d., 13s. 5¼d., 13s. 6d., 13s. 7½d., 13s. 9d., 4 p.ct. debenture (1911) 70½, South Metropolitan 92½, 92⅜, Swansea 7 p.ct. preference 101. Supplementary prices, Bournemouth new 6 p.ct. preference fully-paid 11¼, Gas Light and Coke 5 p.ct. debenture (interest from Sept. 1, 1926) 99.

On Wednesday, Alliance and Dublin 83, 84½, British 105, Commercial 4 p.ct. 78⅜, Gas Light and Coke 84½, 84⅜, 85, 85⅛, 85⅜, 3 p.ct. debenture 59⅜, Hastings and St. Leonards 5 p.ct. 89½, Imperial Continental 130, Lea Bridge 5 p.ct. 94½, 95, Montevideo 80, Primitiva 13s. 4½d., 13s. 7½d., 13s. 9d., Tuscan 21s. 6d., 22s., Wandsworth "C" 88½. Supplementary prices, Rochester, Chatham, 6 p.ct. preference 98¾, 99, 8 p.ct. debenture 104, Walton-on-Thames 7¼ p.ct. debenture 102, 102½.

On Thursday, Alliance and Dublin 83¼, British 105, 106, 7 p.ct. preference 117, 118, 4 p.ct. debenture 70, European 6⅞, Gas Light and Coke 84⅜, 85, 85⅛, 85⅜, 3½ p.ct maximum 60½, 4 p.ct. preference 75⅝, Imperial Continental 130, 131, Montevideo 81, Primitiva 13s. 5¼d., 13s. 6d., 13s. 7½d., 13s. 9d., 4 p.ct. debenture (1911) 71½, South Metropolitan 92, 93, South Suburban 5 p.ct. 99.

On Friday, Bombay 20s. 10½d., 21s. 4½d., Bristol 5 p.ct. max. 84, Cape Town 4½ p.ct. preference 6¼, European 6⅞, Gas Light and Coke 85, 85½, 3½ p.ct. maximum 59⅛, 4 p.ct. preference 76½, Primitiva 13s. 7½d., 13s. 9d., 13s. 10½d., 14s., 14s. 1½d., San Paulo 6 p.ct. preference 7⅞, 7⅜, South Metropolitan 92⅛, 92⅜, 92¼, 92⅛, South Suburban 5 p.ct. debenture 93½.

In the Money Market, credit was in almost superabundant supply. New money was available from 3⅜ p.ct. down to 3 p.ct. Forty-five millions Treasury Bills were again offered; and though the applications, totalling fifty-six millions, were not so heavy as for the last three weeks, the average rate at which the Bills were allotted was again lower at £4 13s. 4·23d. p.ct. Business was less active in the discount market, rates being maintained at 4⅜ p.ct.

French francs again dominated the Foreign Exchange Market. Contrary to anticipation the quotation again advanced, and, after touching 123⅜, closed at 124¼. Italian lire moved upward with the franc, finally closing at 111⅜. Belgas were steady at 34.86½; and the quotation for Sterling on New York was 4.84⅞-4.84⅞.

Silver was firmer on Chinese buying, the cash price rising to 24⅝d. per oz. Gold remained at the nominal price of 84s. 11½d. per oz.

The Bank Rate is 5 p.ct., to which it was raised from 4 p.ct. on Dec. 3. Bankers' deposit rates are 3 p.ct. The deposit rates of the discount houses are 3 p.ct. at call and 3¼ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Dec. 3.	Rise or Fall on week.	Transactions Lowest and Highest Prices.
£			%p.a.	% p.a.				
171,978	Stk.	Aug. 12	5	5	Aldershot 5 p.c. max. C.	72—75	..	..
222,992	,,	,,	4	4	Do. 4 p.c. Pref.	65—70	..	..
1,551,868	,,	Sept. 30	6½	6½	Alliance & Dublin Ord.	81—86	−2	83—84½
274,000	,,	July 8	4	4	Do. 4 p.c. Deb.	67—70	..	..
300,000	1	Oct. 14	1/7½	1/7½	Bombay, Ltd.	1—1½	..	20/10½—21/4½
170,000	10	Aug. 26	8½	8½	Bournemouth 5 p.c.	12—13	..	12⅝—12¾
500,050	10	,,	7	7	Do. B 7 p.c.	12—13	..	..
275,000	10	,,	6	6	Do. Pref. 6 p.c.	11—12	..	..
50,000	Stk.	June 24	3	3	Do. 3 p.c. Deb.	54—57	..	..
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	74—77	..	..
214,740	,,	Aug. 26	12	12	Brighton & Hove Orig.	163—168	..	..
244,200	,,	,,	9	9	Do. A Ord.	125—130	..	..
1,287,500	,,	July 22	5	5	Bristol 5 p.c. max.	85½—86½a	..	..
855,000	,,	Sept. 30	7	8	British Ord.	102—107	..	105—106
100,000	,,	June 24	7	7	Do. 7 p.c. Pref.	114—119	..	117—118
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	68—73	..	70
100,000	10	June 10	6	8	Cape Town, Ltd.	7—8	..	..
100,000	10	Oct. 28	4½	4½	Do. 4½ p.c. Pref.	6—7	..	6½
150,000	Stk.	June 24	4½	4½	Do. 4½ p.c. Deb.	68—73	..	..
696,860	,,	July 22	6	6	Cardiff Con. Ord.	96—99	+2	..
237,860	,,	June 24	7½	7½	Do. 7½ p.c. Red. Deb.	99—102	..	..
157,150	,,	Aug. 12	6½	5	Chester 5 p.c. Ord.	89—94b	..	..
79,185	1	Sept. 30	‡2/-	‡2/-	Colombo Ltd. Ord.	27/—29/-	..	..
24,495	1	,,	1/4⅛	1/4⅛	Do. 7 p.c. Pref.	20/—22/-	..	..
321,490	1	Oct. 14	1/3⅜	1/7½	Colonial Gas Assn. Ld. Ord.	25/—27/-	−1/-	..
173,900	1	,,	1/9⅜	1/7½	Do. 8 p.c. Pref.	21/—23/-	..	..
1,513,280	Stk.	Aug. 1	5½	5½	Commercial 4 p.c. Cap.	77—80	..	78⅜
560,000	,,	,,	5/3/4	5/3/4	Do. 3½ p.c. Cap.	74—77	..	75
475,000	,,	June 24	3	3	Do 3 p.c. Deb.	55—58	..	..
800,000	,,	Sept. 30	§2	§1	Continental Union, Ltd.	27—32	..	..
200,000	,,	,,	7	7	Do. 7 p.c. Pref.	82—86	..	..
737,150	,,	Aug. 12	6½	6½	Croydon sliding scale	96—99	..	..
403,100	,,	,,	5	5	Do. max. div.	78—81	..	..
492,270	,,	Aug. 26	9	6	Derby Con.	107—109e	..	..
55,000	,,	June 24	4	4	Do. Deb.	73—75c	..	..
309,000	,,	Sept. 16	5	5	East Hull Ord. 5 p.c.	78—82	−5½	..
50,000	,,	June 24	5	5	Eastbourne 5 p.c. Deb.	91—96	..	..
1,002,180	10	Sept. 30	†4	†3	European, Ltd.	6⅞—7⅛	..	6⅞—6¾
18,788,960	Stk.	Aug. 12	4/17/4	5/1/4	Gas Light & Coke 4 p.c. Ord.	84—85	+1	84—85½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	58—61	..	59½—60½
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	74—77	..	75½—76½
5,602,620	,,	June 24	3	3	Do. 3 p.c. Con. Deb.	58—61	..	58½—59⅝
181,315	,,	,,	—	6	Do. 6 p.c. Br'tf'd Rd. Db.	100—105	..	..
180,000	,,	—	10	10	Do. 10 p.c. Bonds.	..	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Aug. 26	6⅜	6⅜	Hastings & St L. 5 p.c. Conv	87—92	..	89½
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	66—71	..	..
70,000	10	Oct. 14	†10	†10	Hongkong & China, Ltd.	19—20	..	..
173,200	Stk.	Sept. 16	5	5	Hornsey Con. 3½ p.c.	69—71	..	..
1,976,000	,,	Nov. 11	‡10	10	Imperial Continental Cap.	128—133	..	130—131
226,170	,,	Aug. 12	3½	3½	Do. 3½ p.c. Red. Deb.	68—71	..	..
235,242	,,	Aug. 12	6½	6½	Lea Bridge 5 p.c. Ord.	92—97	..	94½—95
2,127,340	,,	Aug. 12	5½	5½	Liverpool 5 p.c. Ord.	80—81b	−½	..
600,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	102—105b	..	..
165,736	,,	Aug. 26	8	9	Maidstone 5 p.c. Cap.	112—117	..	..
63,480	,,	June 24	3	3	Do. 3 p.c. Deb.	53—58	..	..
75,000	5	June 24	†6	†7	Malta & Mediterranean	5½—5¾	..	..
541,920	Stk.	Nov. 25	†6	†5	Montevideo, Ltd.	79—82*	+1	80—81
2,081,315	,,	Aug. 12	5	5	Newcastle & Gateshead Con.	72½—73½d	..	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	73—74d	..	..
529,705	,,	June 24	3½	3½	Do. 3½ p.c. Deb.	68½—69d	..	..
15,000	,,	Aug. 26	11½	11½	North Middlesex 10 p.c.	155—160	..	..
91,530	,,	,,	8⅝	8⅝	Do. 7 p.c.	109—114	..	..
300,000	,,	Nov. 25	7	9	Oriental, Ltd.	95—100*	..	..
188,120	,,	June 24	7¼	7¼	Plym'th & Ston'house 5 p.c.	108—113	..	..
414,500	,,	Aug. 26	—	7/4/0	Portsm'th Con. Stk. 4p.c. Std.	102—107	..	..
236,732	,,	,,	—	5/0/0	Do. 5 p.c. max.	78—81	..	..
4,389,909	1	—	—	—	Primitiva Ord.	13/6—14/6	+1/-	13/3—14/1½
282,200	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb.	83—85*	−1	..
600,000	Stk.	July 22	4	4	Do. 4 p.c. Red. Deb. 1911	70—72	..	70½—71½
434,963	,,	—	—	—	Do. 4 p.c. Cons. Deb.	70—72	..	..
150,000	10	Sept. 30	6	6	San Paulo 6 p.c. Pref.	7⅛—8	..	7⅛—7⅜
125,000	50	July 1	5	5	Do. 5 p.c. Red. Deb.	46—49	..	..
270,000	Stk.	Sept. 16	6	5⅜	Sheffield A	97—99e	..	..
419,968	,,	,,	6	5⅜	Do. B	97—99e	..	..
1,047,000	,,	,,	6	5⅜	Do. C	97—99e	..	..
90,000	10	June 11	4	—	South African	4—6	−1	..
6,609,895	Stk.	Aug. 12	7	5	South Met. Ord.	91½—93½	+½	92—93
1,895,445	,,	July 8	3	3	Do. 3 p.c. Deb.	57—60	..	..
734,000	,,	Sept. 16	6½	6½	Do. 6½ p.c. Red. Db.	100—102	..	..
91,500	,,	Aug. 12	8⅜	8⅜	South Shields Con.	114—116d	..	..
1,187,795	,,	Aug. 12	6½	6½	South Suburban Ord. 5 p.c.	96—99	..	99
368,837	,,	June 24	5	5	Do. 5 p.c. Deb.	92—95	..	93½
647,740	,,	Oct. 14	5	5	South'mpton Ord. 5 p.c. max.	75—78	..	..
121,275	,,	June 24	4	4	Do. 4 p.c. Deb.	68—73	..	..
250,000	,,	Aug. 26	7	7	Swansea 7 p.c. Red. Pref.	100—102	..	101
200,000	,,	June 24	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
120,000	,,	July 22	7⅛	7⅛	Tottenham District A 5 p.c.	105—110	..	..
882,275	,,	,,	5⅜	6⅛	Do. B 3½ p.c.	88—91	..	..
150,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	99—101	..	..
181,255	,,	June 10	4	4	Do. 4 p.c. Deb.	73—76	..	..
358,251	,,	Aug. 26	5	5	Tynemouth Con. and New	67—68d	..	..
197,294	,,	Aug. 26	6⅜	6½	Uxbridge, Maidenhead, & Wycombe 5 p.c.	85—90	..	..
88,330	,,	,,	5	5	Do. 5 p.c. pref.	80—85	..	..
91,800	,,	,,	6⅜	6½	Do. 5 p.c. Maidenh'd	85—90	..	..
30,000	,,	July 8	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	122—127	..	..
256,636	,,	,,	7	7	Do. B 3½ p.c.	102—107	..	..
412,450	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	88½
352,000	,,	,,	6⅜	6⅜	Wimbledon 5 p.c.	98—103	..	..
96,000	,,	,,	7⅛	7⅛	Epsom 5 p.c.	104—109	..	..
88,416	,,	June 24	3	3	3 p.c. Deb.	54—57	..	..

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *Ex. div. † Paid free of income-tax. ‡ Plus 8½ p.ct. p.a. special dividend. § For year.

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